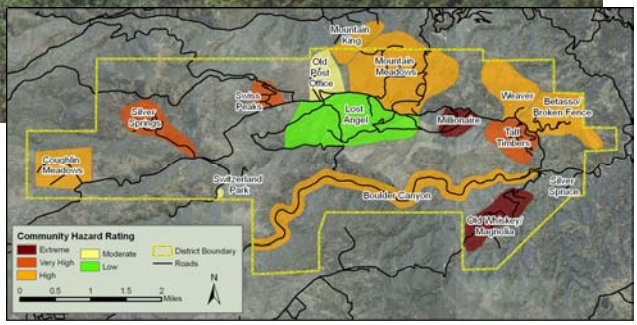
SUGAR LOAF FIRE PROTECTION DISTRICT BOULDER, COLORADO

Wildland Urban Interface: Community Wildfire Protection Plan



Prepared for:
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August 2008

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FIRE MANAGEMENT

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SUMMARY OF THIS DOCUMENT

This document incorporates new and existing information relating to wildfire for citizens, policy makers, and public agencies in the Sugar Loaf Fire Protection District (SLFPD), Boulder, CO. Wildfire hazard data is derived from the community wildfire hazard rating analysis (WHR) and the analysis of fire behavior potential, which are extensive and/or technical in nature. As a result, detailed findings and methodologies are included in their entirety in appendices rather than the main report text. This approach is designed to make the plan more readable, while establishing a reference source for those interested in the technical elements of the SLFPD wildfire hazard and risk assessment.

The SLFPD Community Wildfire Protection Plan (CWPP) is the result of a community-wide fire protection planning effort that includes extensive field data gathering, compilation of existing fire suppression documents, a scientific analysis of the fire behavior potential of the study area, and collaboration with various participants: homeowners, SLFPD officials, and the Colorado State Forest Service (CSFS). This project meets the requirements of the federal Healthy Forests Restoration Act (HFRA) of 2003 for community fire planning.

The CWPP meets the requirements of HFRA by:

1. **Identifying and prioritizing fuels reduction opportunities across the landscape**
   See *Fuels Modification Projects FMU* starting on page 38 of this document.

2. **Addressing structural ignitability**
   See page 34 and **Appendix B**

3. **Collaborating with stakeholders**
   See **Appendix E**

THE NATIONAL FIRE PLAN

In 2000, more than eight million acres burned across the United States, marking one of the most devastating wildfire seasons in American history. One high-profile incident, the Cerro Grande fire at Los Alamos, NM, destroyed more than 235 structures and threatened the Department of Energy's nuclear research facility.

Two reports addressing federal wildland fire management were initiated after the 2000 fire season. The first was a document prepared by a federal interagency group entitled "Review and Update of the 1995 Federal Wildland Fire Management Policy" (2001), which concluded among other points that the condition of America's forests had continued to deteriorate.

The second report issued by the Bureau of Land Management (BLM) and the United States Department of Agriculture Forest Service (USFS) - "Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of

2000" - would become known as the National Fire Plan (NFP). That report, and the ensuing congressional appropriations, ultimately required actions to:

1. Respond to severe fires
2. Reduce the impact of fire on rural communities and the environment
3. Ensure sufficient firefighting resources

Congress increased its specific appropriations to accomplish these goals. But 2002 was another severe season, with more than 1,200 homes destroyed and seven million acres burned. In response to public pressure, Congress and the Bush administration continued to obligate funds for specific actionable items, such as preparedness and suppression. That same year, the Bush administration announced the HFRA initiative, which enhanced measures to restore forest and rangeland health and reduce the risk of catastrophic wildfires. In 2003, that act was signed into law.

Through these watershed pieces of legislation, Congress continues to appropriate specific funding to address five main sub-categories: preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters. The general concepts of the NFP blended well with the established need for community wildfire protection in the study area. The spirit of the NFP is reflected in the SLFPD CWPP.

PURPOSE

The purpose of the risk analysis, fire behavior analysis, community wildfire hazard rating (WHR) and the resulting CWPP is to provide a comprehensive, scientifically-based assessment of the wildfire hazards and risks within the SLFPD.

The assessment estimates the risks and hazards associated with wildland fire in proximity to communities. This information, in conjunction with Values at Risk, defines "areas of concern" for the community and allows for prioritization of mitigation efforts. From these analyses, solutions and mitigation recommendations are offered that will aid homeowners, land managers and other interested parties in developing short-term and long-term fuels and fire management plans. For the purposes of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is the combination of the WHR ratings of the Wildland Urban Interface (WUI) communities and the analysis of fire behavior potential, as modeled from the fuels, weather and topography of the study area. Hazard attempts to quantify the severity of undesirable fire outcomes to the Values at Risk.

Values at Risk are the human and intrinsic values identified as important to the way of life of the study area by its inhabitants, such as life safety, property conservation, access to recreation and wildlife habitat. (See pages 12-14 for a comprehensive overview.)

GOALS AND OBJECTIVES

Goals for this project include the following:

1. Enhance Life Safety for Residents and Responders
2. Mitigate Undesirable Fire Outcomes to Property and Infrastructure
3. Mitigate Undesirable Fire Outcomes to the Environment and Quality of Life

In order to accomplish these goals the following objectives have been identified:

1. Establish an approximate level of risk (the likelihood of a significant wildfire event for the study area)
2. Provide a scientific analysis of the fire behavior potential of the study area
3. Group Values at Risk into "communities" that represent relatively similar hazard factors
4. Identify and quantify factors that limit (mitigate) undesirable fire effects to the Values at Risk (hazard levels)
5. Recommend specific actions that will reduce hazards to the Values at Risk

OTHER DESIRED OUTCOMES

1. Promote community awareness:

   Quantification of the community's hazards and risk from wildfire will facilitate public awareness and assist in creating public action to mitigate the defined hazards.

2. Improve wildfire prevention through education:

   Awareness, combined with education, will help to reduce the risk of unplanned human ignitions.

3. Facilitate and prioritize appropriate hazardous fuel reduction:

   Organizing and prioritizing hazard mitigation actions into Fire Management Units (FMU) can assist stakeholders in focusing future efforts from both a social and fire management perspective.

4. Promote improved levels of response:

   The identification of areas of concern will improve the accuracy of pre-planning, and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

COLLABORATION: COMMUNITY/AGENCY/STAKEHOLDERS

Representatives involved in the development of the SLFPD CWPP are included in Table 1, along with their organization and their roles and responsibilities. For more information on the collaborative process that led to the development of this CWPP, see **Appendix E:** *SLFPD CWPP Collaborative Effort.*

TABLE 1. CWPP Development Team

Name	Organization	Roles / Responsibilities
• David Lasky • Miles Lahue	Sugar Loaf Fire Protection District	Local information and expertise, including community risk and value assessment, development of community protection priorities, and establishment of fuels treatment project areas and methods.
• Alan Owen, District Forester • Bob Bundy	Colorado State Forest Service	Facilitation of planning process and approval of CWPP minimum standards.
• Rod Moraga, Project Manager • Chris White, Managing Partner • Mark McLean, GIS Project Manager	Anchor Point Group LLC Consultants	Development of the CWPP, decision-making, community risk and value assessment, development of community protection priorities, establishment of fuels treatment project areas and methods.

STUDY AREA OVERVIEW

The Sugar Loaf Fire Protection District (SLFPD) is located in Boulder County, Colorado. SLFPD covers an area of 17 square miles, and ranges in elevation from 5,900 to 9,200 feet. The SLFPD includes approximately 500 homes; a water treatment plant for the city of Boulder, Boulder County Open Space, and the City of Boulder Mountain Parks; BLM inholdings and several thousand acres of Arapahoe-Roosevelt National Forest land. The SLFPD is served by an all-volunteer fire department, which varies between 30 and 40 members, and typically responds to about 110 calls each year: two thirds are medical in nature, one third are more traditional fire calls.

The district is bordered by various other suppression agencies including the Four Mile Fire Protection District, Rocky Mountain Fire Authority, Indian Peaks Fire Department, Timberline Fire Authority, and Nederland Fire Protection District.

For the purposes of this report, communities have been assessed for the hazards and risks that occur inside the district boundaries. GIS work for this project has been extended to a project boundary beyond the district boundaries. Unless noted otherwise, rankings and descriptions of communities, as well as hazard and risk recommendations, pertain only to the portions of those areas that lie within the boundaries of the Sugar Loaf Fire Protection District.

The study area is considered to be in the Foothill / Montane life zone (6,000'-10,000') of the eastern slope of the Northern Colorado Front Range.[1] The dominant vegetation is Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*). The foothill area also contains dense stands of mixed conifers primarily on north facing slopes. Dense riparian shrub corridors and open canopy woodlands broken by large grass meadows also exist in this area.

Figure 2 and **Table 2** show the communities that define the WUI study area. For the purposes of this project, the most populated areas were divided into 15 communities. Each community represents certain dominant hazards from a wildfire perspective. The overall hazard ranking of these communities is determined by considering the following variables: fuels, topography, structural flammability, availability of water for fire suppression, egress and navigational difficulties, and other hazards, both natural and manmade. The methodology for this assessment uses the WHR community hazard rating system developed specifically to evaluate communities within the WUI for their relative wildfire hazard.[2] The WHR model combines physical infrastructure such as structure density and roads, and fire behavior components like fuels and topography, with the field experience and knowledge of wildland fire experts. For more information on the WHR methodology please see **Appendix B**.

1 Elevation limits for life zones were based on life zone ranges from: Jack Carter, "Trees and Shrubs of Colorado" (Boulder, CO, Johnson Books, 1998).

2 C. White, "Community Wildfire Hazard Rating Form" *Wildfire Hazard Mitigation and Response Plan*, Colorado State Forest Service, Ft. Collins, CO, 1986.

FIGURE 1. Sugar Loaf Community Hazard Rating Map

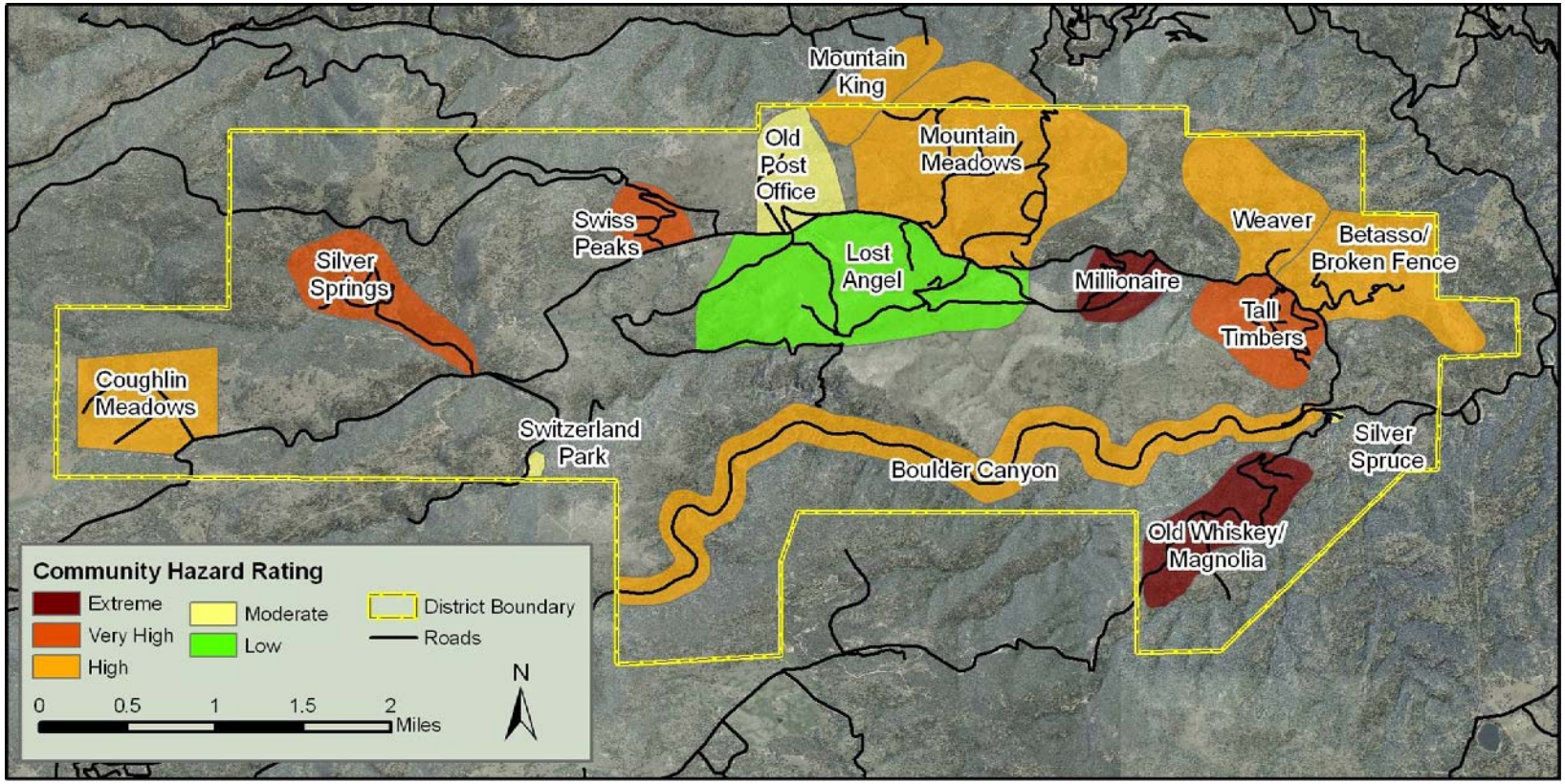


TABLE 2. Study Area Communities

1. Old Whiskey / Magnolia	8. Mountain Meadows
2. Millionaire	9. Mountain King
3. Tall Timbers	10. Boulder Canyon
4. Swiss Peaks	11. Coughlin Meadows
5. Silver Springs	12. Old Post Office
6. Betasso / Broken Fence	13. Switzerland Park
7. Weaver	14. Lost Angel
XXXXXXX	15. Silver Spruce

For reference to the rest of this document, **Figure 2** and **Figure 3** show the general topography of the area. These graphic representations of the landforms of the study area (elevation and slope) will be helpful in interpreting other map products in this report.

FIGURE 2. SLFPD Slopes

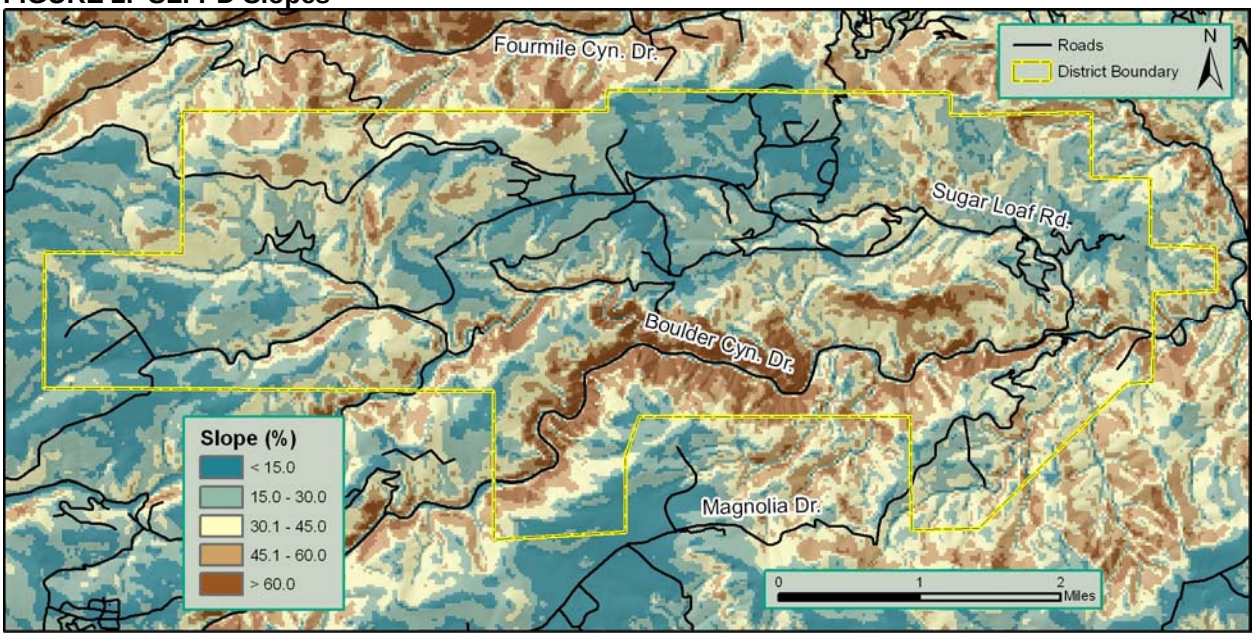
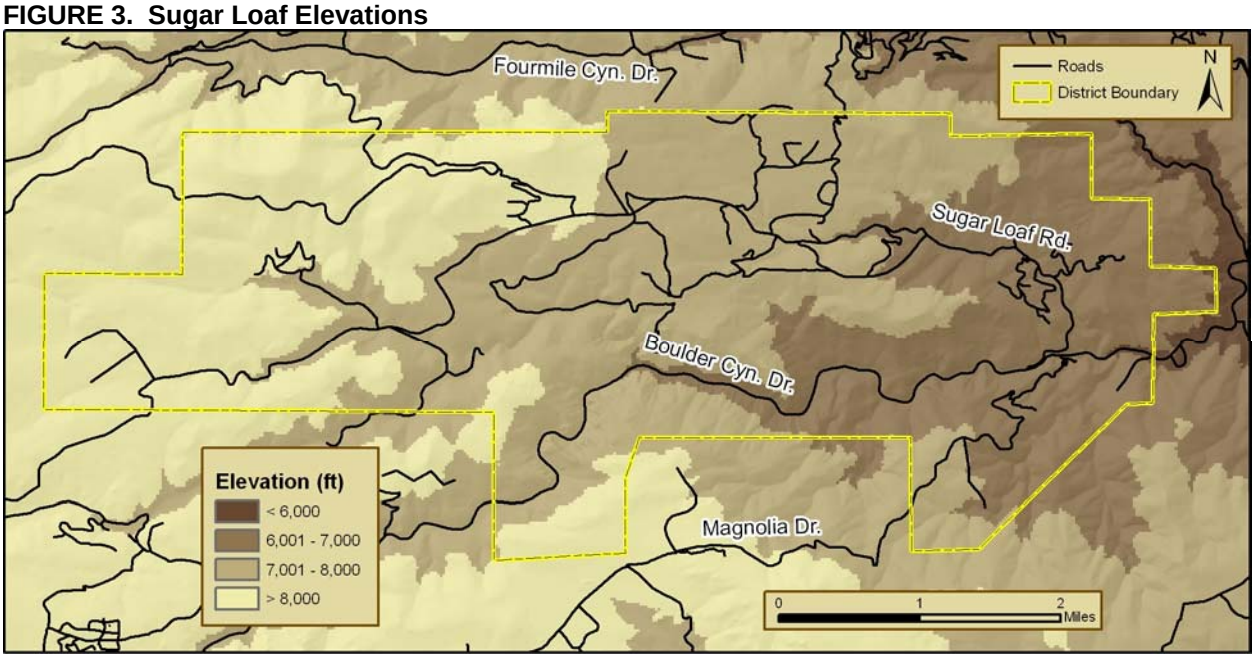


FIGURE 3. Sugar Loaf Elevations



VALUES AT RISK

LIFE SAFETY AND HOMES

There are approximately 2500 citizens residing in 500 residences within the SLFPD. These Wildland Urban Interface (WUI) areas were divided into 15 communities. The areas within each community represent certain dominant hazards from a wildfire perspective. Fuels, topography, structural flammability, availability of water for fire suppression, egress and access difficulties, as well as other hazards both natural and manmade, are considered in the overall hazard ranking of these communities. The hazard assessment identified five of the 15 communities in the study area to be extreme or very high hazard areas. Under extreme burning conditions, there is a likelihood of rapid increases in fire intensity and spread in these areas due to steep topography, fast burning or flashy fuel components and other topographic features that contribute to channeling winds and promotion of extreme fire behavior. These areas may also represent a high threat to life safety due to poor egress, the likelihood of heavy smoke, heat, and /or long response times.

With tens of thousands of people moving to Colorado each year, building in the once inaccessible mountain areas has become a growing concern. Most of Boulder County is vulnerable to some form of natural disturbance. Recent national disaster events have focused increased attention at both local and state government levels on the need to mitigate such events where possible and to prepare to cope with them when unavoidable.

Boulder County recognizes the WUI as an area particularly at risk to wildland fires. Fire should be recognized as a natural and/or human-caused occurrence with certain benefits to the ecosystem. The county should strive towards balancing the natural processes of the ecosystem with development concerns so that residents may co-exist in a fire-dependent ecosystem.[3]

Boulder County experiences an average of 100 fire starts per year. Over the past 20 years the county has seen a number of major wildland fires, and until 2001, held the Colorado record for structural losses from wildland fires. This was due largely to the 1989 Black Tiger fire, which claimed 44 homes in the SLFPD.

3 Boulder County Comprehensive Plan - Boulder County Land Use Department (http://www.co.boulder.co.us/lu/bccp/introduction.htm).

COMMERCE AND INFRASTRUCTURE

Commercial property and retail business are limited within the wildland/urban interface portions of the SLFPD. However, some residents maintain a variety of home-based businesses. Agricultural properties and livestock-related businesses also exist in some portions of the study area.

In 1978, the *Boulder County Comprehensive Plan* was adopted. This and most other local municipal plans and programs emphasize the fact that environmental factors, natural and cultural amenities, and "quality of life" issues are all crucial to the health of the economy. Indeed, the economy of the area is based largely on the quality of life that attracts professionals to establish residences there. Quality of life in Boulder County, and by extension its economy, have benefited enormously from a legacy of careful land-use decisions and the county's commitment to creating and maintaining open space properties, which include national and state parks, national and state forests, and city and county open space and parks.[4] Because the quality of life is tied so closely to the land, wildfire has the potential to cause significant damage to the local economy.

RECREATION AND LIFESTYLE

The culture of Boulder County emphasizes environmental values and outdoor recreation. Boulder County has intermixed land ownership: approximately 60% of the land is owned publicly with 40% owned privately. Public land is divided among a variety of local, state, and federal managers, including the United States Forest Service, Boulder County Open Space, the City of Boulder and Colorado State Parks.[5]

The *Boulder County Comprehensive Plan* included goals and policies for preserving open space, protecting environmental resources (including both natural and cultural resources) and developing a county-wide trail system. The implementation of the open space plan has been based on both private cooperation and on the county's financial ability to acquire an interest in these lands.

By early 1998, the county open space program comprised more than 52,000 acres of preserved land scattered throughout the county, along with 70 miles of trails. The majority of this land is open for public use. The remainder is under agricultural lease or conservation easements, which do not include public access. Most of the properties are well-suited to passive recreation.[6] Residents who live in the study area have a keen appreciation for their natural environment. Recreation and the natural beauty of the area, values which can be seriously damaged by wildfire, are frequently quoted as reasons local residents have chosen to live in the study area.

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4 Boulder County Comprehensive Plan – Boulder County Land Use Department (http://www.co.boulder.co.us/lu/bccp/introduction.htm)

5 "Community Responses to Wildland Fire Threats in Colorado" – T. Steelman, D. Bell, Dept. of Forestry, NCSU (http://www.ncsu.edu/project/wildfire/Colorado/boulder/boulder.html)

6 Ibid

HABITAT EFFECTIVENESS & ENVIRONMENTAL RESOURCES

Residents are clear that the preservation of wildlife and the environment is important to the quality of life in the area. Habitat effectiveness is defined as the degree to which habitat is free of human disturbance and available for wildlife to use. Effective habitat is mostly undisturbed land area, which is buffered (at least 300 feet in essentially all situations) from regular motorized and non-motorized use of roads and trails (11 or more people or vehicle trips per week). It is felt that habitat effectiveness should not fall below 50%, and the best wildlife habitats have a much higher percentage.[7] Wildfire, specifically severe wildfire, can have significant adverse effects on habitat effectiveness.

The environmental character of Boulder County is due in large measure to the abrupt altitudinal variation within a 20-mile east-west gradient. The dramatic landform changes sharply define the native ecosystems and their associations of plant and animal species.[8]

The county's environmental heritage includes non-renewable resources such as natural areas, historic/archaeological sites, and natural landmarks. As irreplaceable resources, they warrant preservation from destruction or harmful alteration. Wetlands are critical environmental resources that function variously as wildlife habitat, aquifer recharge areas, linkages in the overall county wildlife system, and aids for smog control.[9]

The SLFPD CWPP process is in concert with these guiding principles. Through public involvement, local support, and a regional perspective, the fuels reduction elements described in this document can and should enhance and protect the values of the study area.

7 Peak to Peak Community Indicators Project 2003 Presented by Peak to Peak Healthy Communities Project ©Copyright 2003 Peak to Peak Healthy Communities Project

8 Boulder County Comprehensive Plan – Boulder County Land Use Department (http://www.co.boulder.co.us/lu/bccp/envres1.htm)

9 Ibid

CURRENT RISK SITUATION

For the purposes of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is the combination of the wildfire hazard ratings of the Wildland Urban Interface (WUI) communities and fire behavior potential, as modeled from the fuels, weather and topography of the study area.

The majority of the district is at a high risk for WUI fires. This assessment is based on the analysis of the following factors, which apply to the study area.

1. Boulder County foothills and mountain areas are listed in the Federal Register as communities at high risk from wildfire (http://www.forestsandrangelands.gov/resources/documents/423-437-en.pdf).
2. The area is shown in the Colorado State Forest Service WUI Hazard Assessment map to be an area of high Hazard Value (an aggregate of Hazard, Risk and Values Layers).
3. Fire history statistics from the Colorado State Forest Service (CSFS) and their cooperator fire departments reflect an active fire history for the years available. CSFS reports 100 fires in 1990, 104 in 1991, 126 in 1992, and 98 in 1993, for a total of 428 in Boulder County for the four-year period.
4. The USDA Forest Service fire regime and condition class evaluation of forest stands in the study area shows that historic fire regimes have been moderately altered. Please see the *Fire Regime and Condition Class* section of this report for details.
5. The surrounding federal lands report an active, but far from extreme, fire history. Fire occurrences for the Boulder Ranger District of the Arapahoe-Roosevelt National Forest (see **Figure 5**) were calculated from the USDA Forest Service Personal Computer Historical Archive for the thirty-year period from 1977-2006. These areas represent federal lands adjacent and within to the study area, but do not include any data from state, county, or private lands. The data have been processed and graphed using the Fire Family Plus software program and are summarized below.

Figure 5a shows the number of fires (red bars) and the total acres burned (blue hatched bars) in the Boulder Ranger District for each year. While the number of annual fires ranges from approximately 5 to over 30 fires per year, there is little year-to-year pattern to the variation. Between 1977 and 2006 there were three other fires burning more than 100 acres in the ranger district. The total number of acres burned was the greatest in 1988, when two large fires accounted for 3,922 acres burned. 1988 also had the highest number of fires on the Boulder Ranger District during the study period. A portion of the Black Tiger Fire burned 1,804 acres in the Boulder Ranger District in 1989.

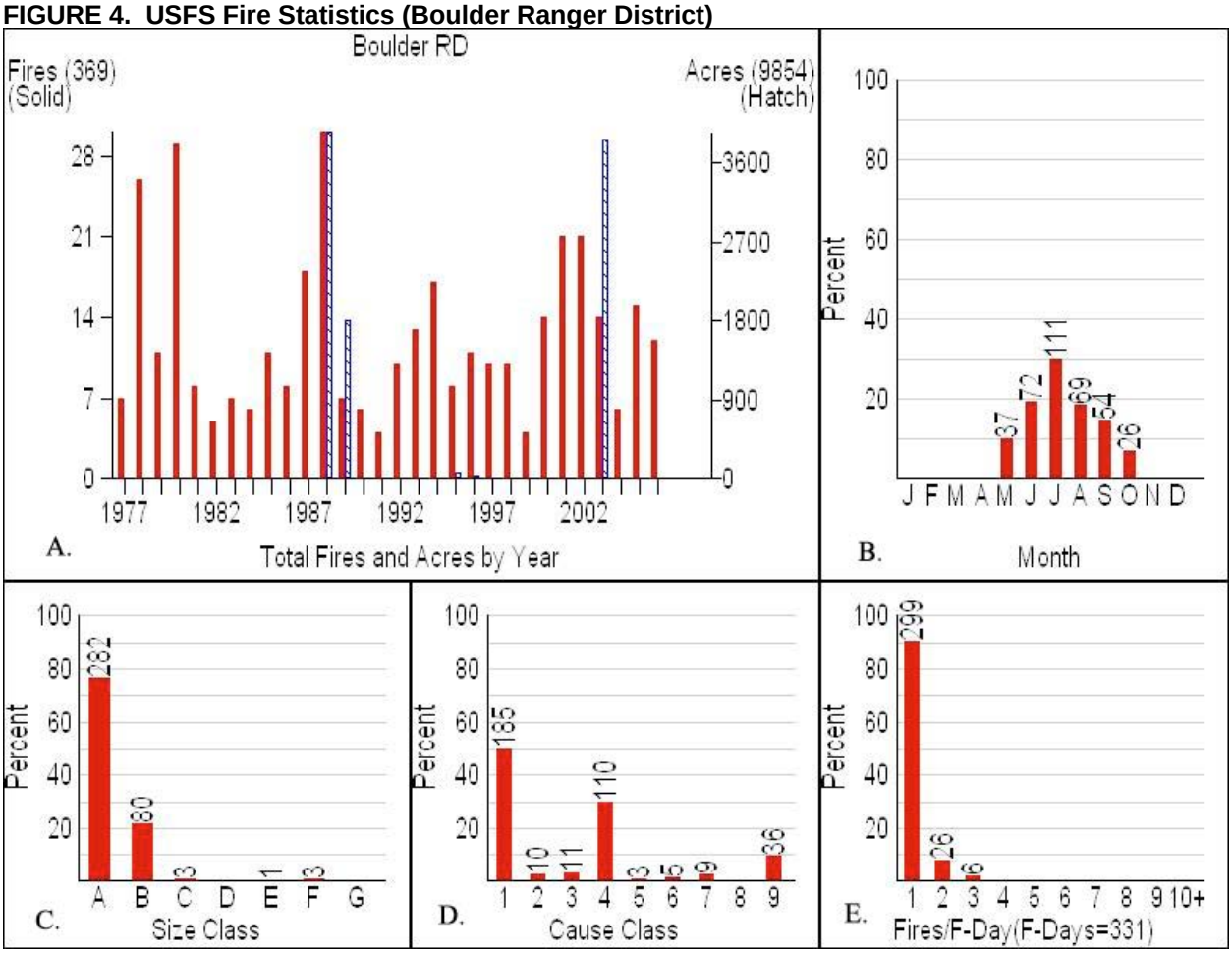
Figure 5b shows the percentage and number of fires between 1977 and 2006 occurring in each month of the year. July had the greatest number of fires, followed by June and August. The fewest fires occurred between the months of November and April, a fact which reflects the climate conditions for the area.

Figure 5c shows the size class distribution of fires. Approximately 78% of the reported fires (288 of 369) were less than 10 acres in size. These statistics reflect the widely held opinion that, throughout the western US, the vast majority of fires are controlled during initial attack.

Figure 5d shows the number of fires caused by each factor. As shown in this graph, the most common cause of ignitions is lightning (50%). However, the next most common cause is campfires (30%). If we remove the miscellaneous cause category, natural causes still represent the majority of ignitions (56% natural and 44% human-caused), but it should be noted that these numbers are for national forest areas which lack the concentrated development and many other risk factors present in the portions of the study area where private land is dominant.

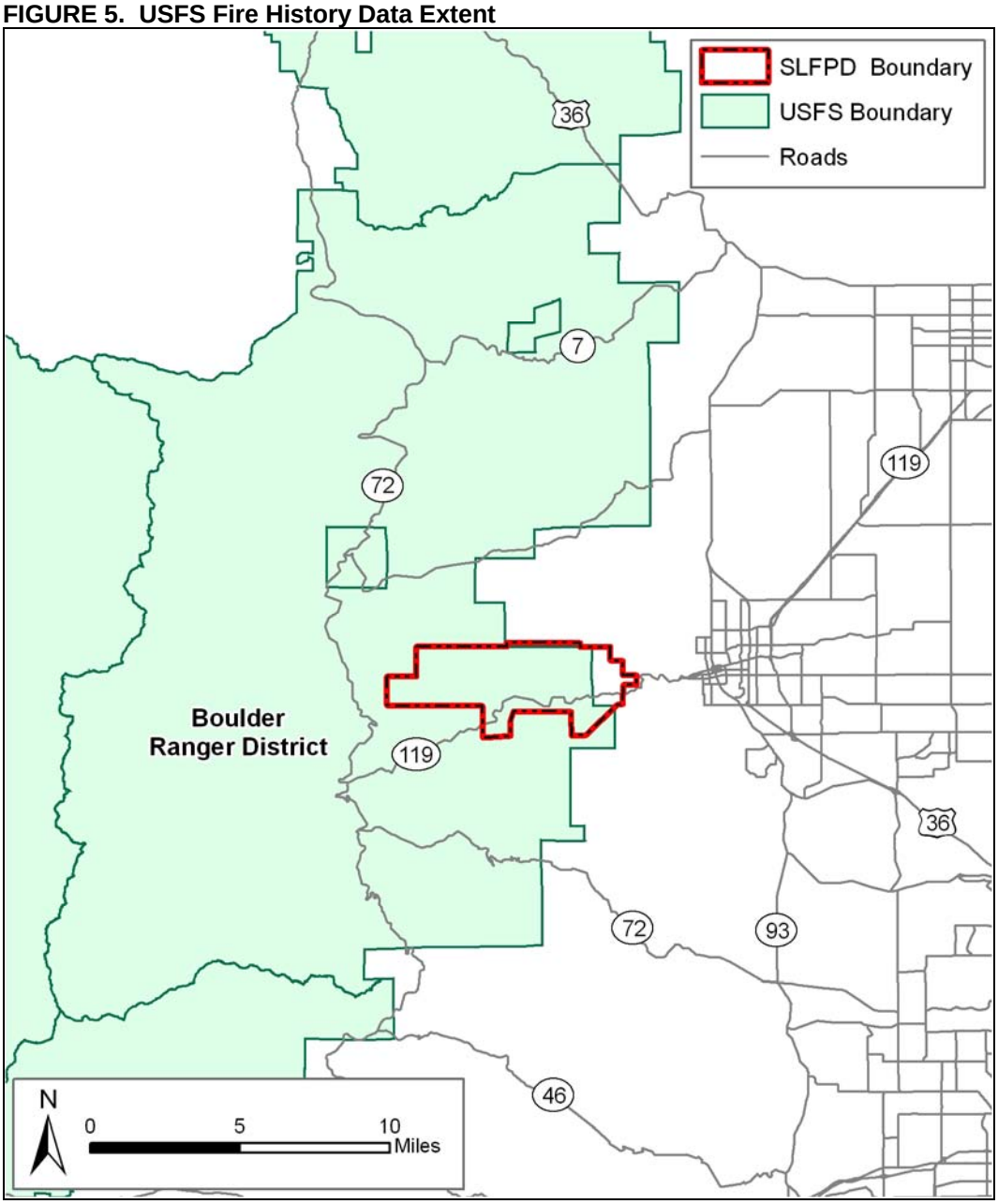
Figure 5e shows the number of fire starts for each day that a fire start was recorded. Most fires (299) occurred on days that only had one fire start. Approximately 8% (26) of fire days had two fire starts recorded and days with three or more fire starts represent less than 2% of all fire start days. The statistics suggest that multiple start days are a rare occurrence compared to fire days with a single ignition.

FIGURE 4. USFS Fire Statistics (Boulder Ranger District)



Size Class (in acres)	A < ¼	B ¼ - 9	C 10 – 99	D 100-299	E 300-999	F 1000 - 4999	G 5000 +		
Causes	1 Lightning	2 Equipment	3 Smoking	4 Campfire	5 Debris Burning	6 Railroad	7 Arson	8 Children	9 Misc.

FIGURE 5. USFS Fire History Data Extent



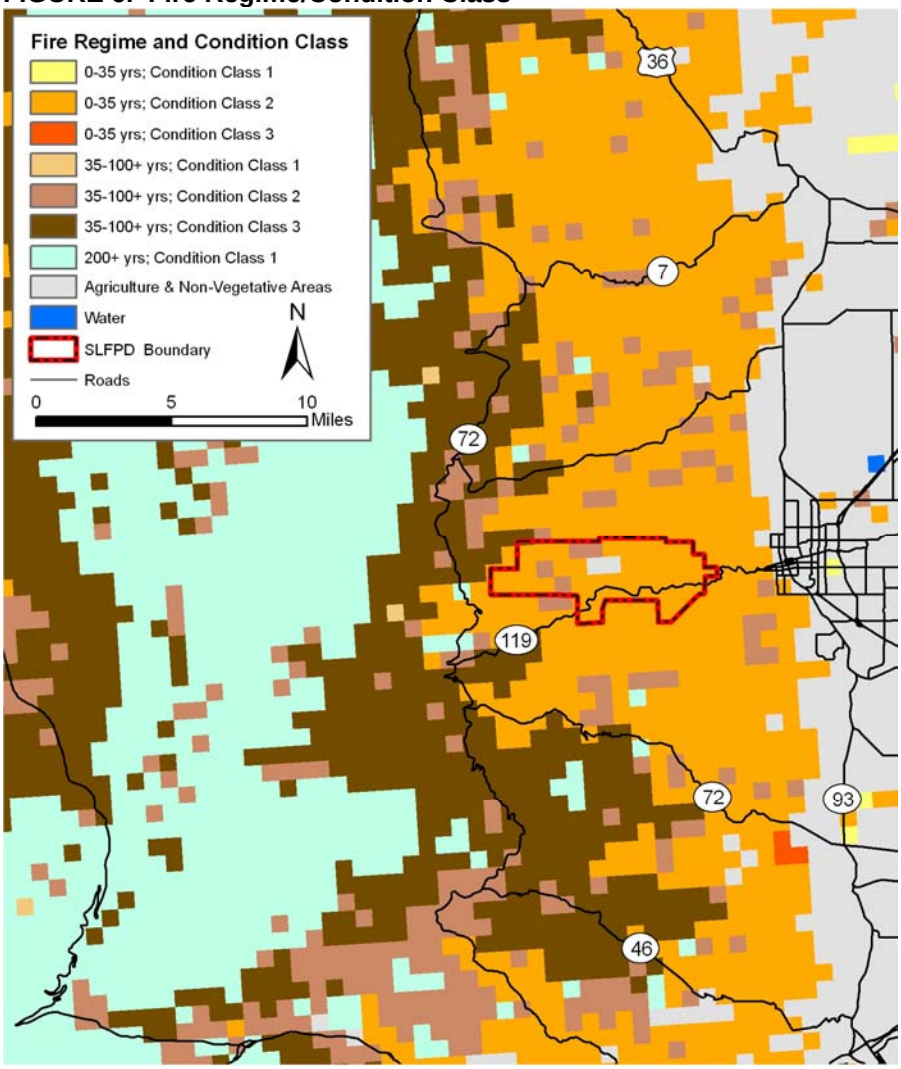
Development is increasing in the study area. As the density of structures and the number of residents in the interface increases, possible ignition sources will multiply. Unless efforts are made to mitigate the potential for human ignition sources spreading to the surrounding forest, the probability of a large wildfire occurrence will increase.

FIRE REGIME CONDITION CLASS

The Fire Regime Condition Class (FRCC) is a landscape evaluation of expected fire behavior as it relates to the departure from historic norms. The data used for this study is from a national level map. The minimum mapping unit for this data is 1 square kilometer. FRCC is not to be confused with BEHAVE and FlamMap fire behavior models (detailed in the fire behavior section) which provide the fire behavior potential analysis for expected flame length, rate of spread and crown fire development.

The FRCC is an expression of the departure of the current condition from the historical fire regime. It is used as a proxy for the probability of severe fire effects (e.g., the loss of key ecosystem components - soil, vegetation structure, species, or alteration of key ecosystem processes - nutrient cycles, hydrologic regimes). Consequently, FRCC is an index of hazards to the status of many components (e.g., water quality, fish status, wildlife habitats, etc.). **Figure 7** displays graphically the return interval and condition class of the study area.

FIGURE 6. Fire Regime/Condition Class



Deriving FRCC entails comparing current conditions to some estimate of the historical range that existed prior to substantial settlement by Euro-Americans. The departure of the current condition from the historical baseline serves as a proxy to likely ecosystem effects. In applying the condition class concept, it is assumed that historical fire regimes represent the conditions under which the ecosystem components within fire-adapted ecosystems evolved and have been maintained over time. Thus, if it is projected that fire intervals and/or fire severity have changed from the historical conditions, then it would be expected that fire size, intensity, and burn patterns would also be subsequently altered if a fire occurred. Furthermore, if it is assumed that these basic fire characteristics have changed, then it is likely that there would be subsequent effects to those ecosystem components that had adapted to the historical fire regimes.

As used here, the potential of ecosystem effects reflect the probability that key ecosystem components would be lost if a fire were to occur within the SLFPD. It should be noted that a key ecosystem component can represent virtually any attribute of an ecosystem (for example, soil productivity, water quality, floral and faunal species, large-diameter trees, snags, etc.).

(FRCC information continues on next page.)

The following categories of condition class are used to qualitatively rank the potential of effects to key ecosystem components:

TABLE 3. Condition Class Descriptions[10]

Condition Class	Condition Class Description
1	Fire regimes are within their historical range and the risk of losing key ecosystem components as a result of wildfire is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range. Fire effects would be similar to those expected under historic fire regimes.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components as a result of wildfire is moderate. Fire frequencies have changed by one or more fire-return intervals (either increased or decreased). Vegetation attributes have been moderately altered from their historical range. Consequently, wildfires would likely be larger, more intense, more severe, and have altered burn patterns, as compared with those expected under historic fire regimes.
3	Fire regimes have changed substantially from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have changed by two or more fire-return intervals. Vegetation attributes have been significantly altered from their historical range. Consequently, wildfires would likely be larger, more intense, and have altered burn patterns, as compared with those expected under historic fire regimes.

The foothill communities of the study area are dominantly classified under Condition Class 2. By definition, historic fire regimes have been moderately altered. Consequently, wildfires are likely to be larger, more severe, and have altered burn patterns, as compared with those expected under historic fire regimes.

10 Fire Regime Condition Class, website, http://www.frcc.gov/, July 2005.

FIRE BEHAVIOR POTENTIAL

As a part of the wildfire hazard analysis carried out for this study, the fire behavior potential of the study area was modeled (see **Appendix A**). This model can be combined with the community wildfire hazard ratings (WHR), structure density and Values at Risk information to generate current and future "areas of concern". **Figures 7-9** show the fire behavior potential for the analysis area, given the average (moderate) weather conditions existing between May 1 and October 31. Weather observations from the Sugarloaf Remote Automated Weather Station (RAWS) were averaged for a thirty-year period (1977-2007) to calculate these conditions.

Figures 10-12 show the fire behavior potential for the analysis area, given ninety-seventh percentile (extreme) weather data. In other words, the weather conditions existing on the five most severe fire weather days in each season for the thirty-year period were averaged together to provide the weather data for this calculation. It is a reasonable assumption that similar conditions may exist for at least five days of the fire season during an average year. In fact, during extreme years such as 2000 and 2002, such conditions may exist for significantly longer periods.

Weather conditions are extremely variable and not all combinations are accounted for. These outputs are best used for pre-planning and not as a stand-alone product for tactical operations. This model can be combined with the WHR and Values at Risk information to generate current and future "areas of concern," which are useful for prioritizing mitigation actions. It is recommended that when this information is used for tactical operations, fire behavior calculations be done with actual weather observations during the fire event. For greatest accuracy, the most current Energy Release Component (ERC) values should be calculated and distributed during the fire season to be used as a guideline for fire behavior potential. For a more complete discussion of the fire behavior potential methodology, please see **Appendix A**.

FIGURE 7. Flame Length, Moderate Weather Conditions

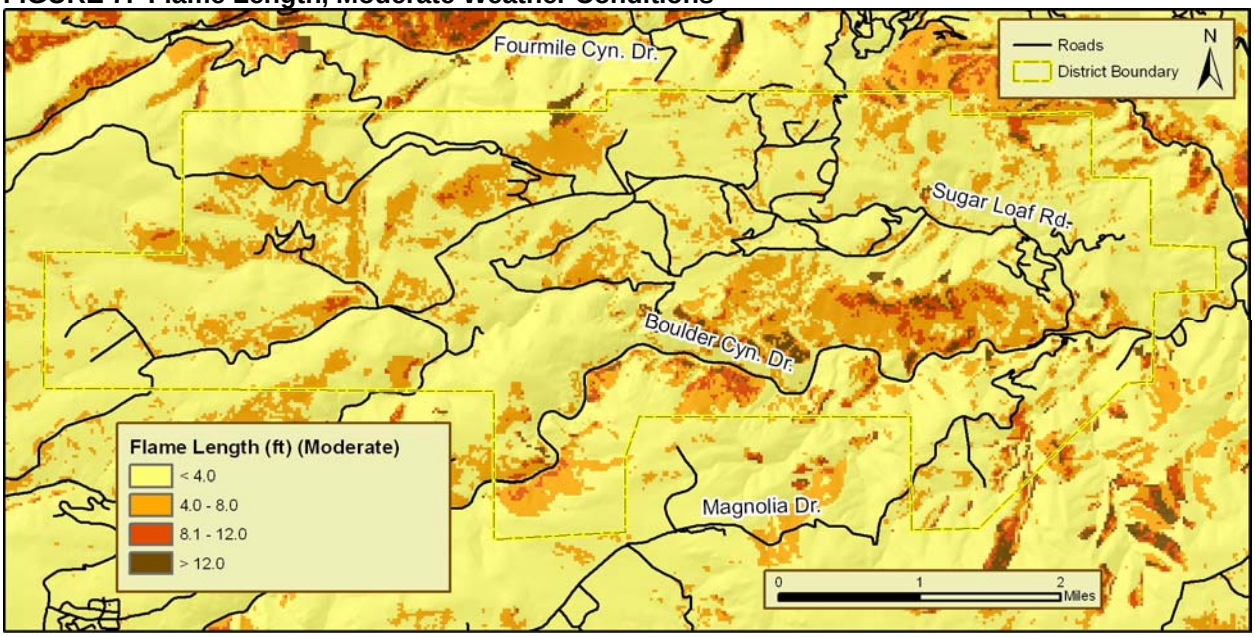


FIGURE 8. Rate of Spread, Moderate Weather Conditions

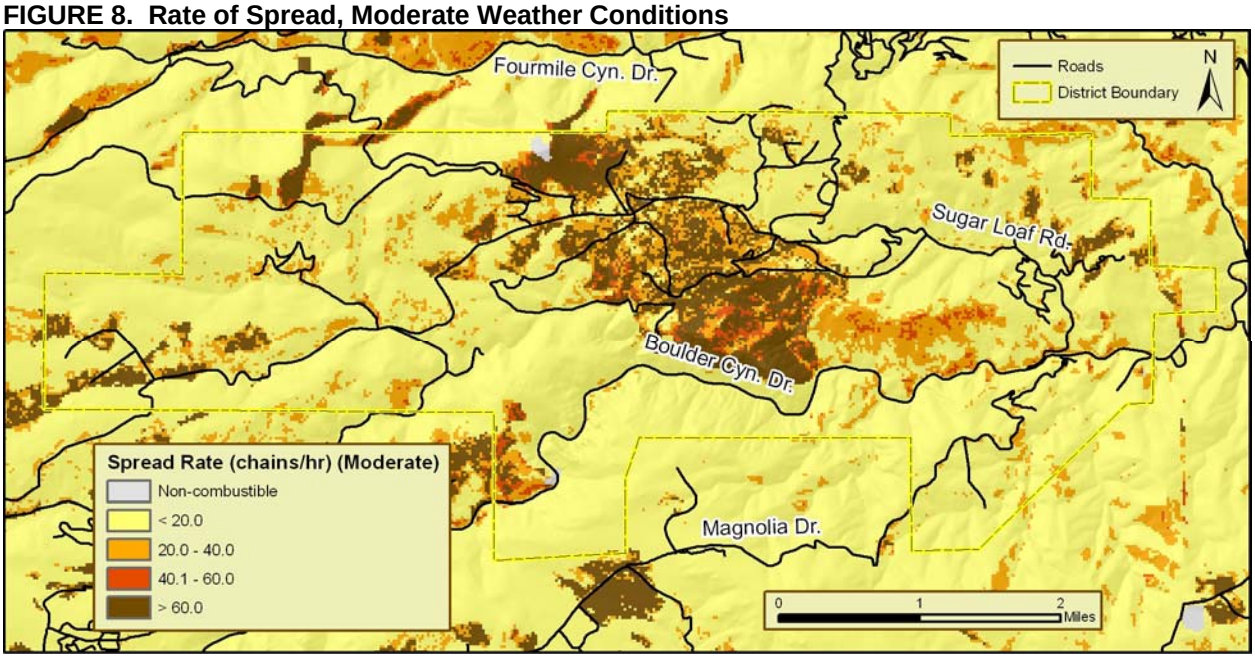


FIGURE 9. Crown Fire Potential, Moderate Weather Conditions

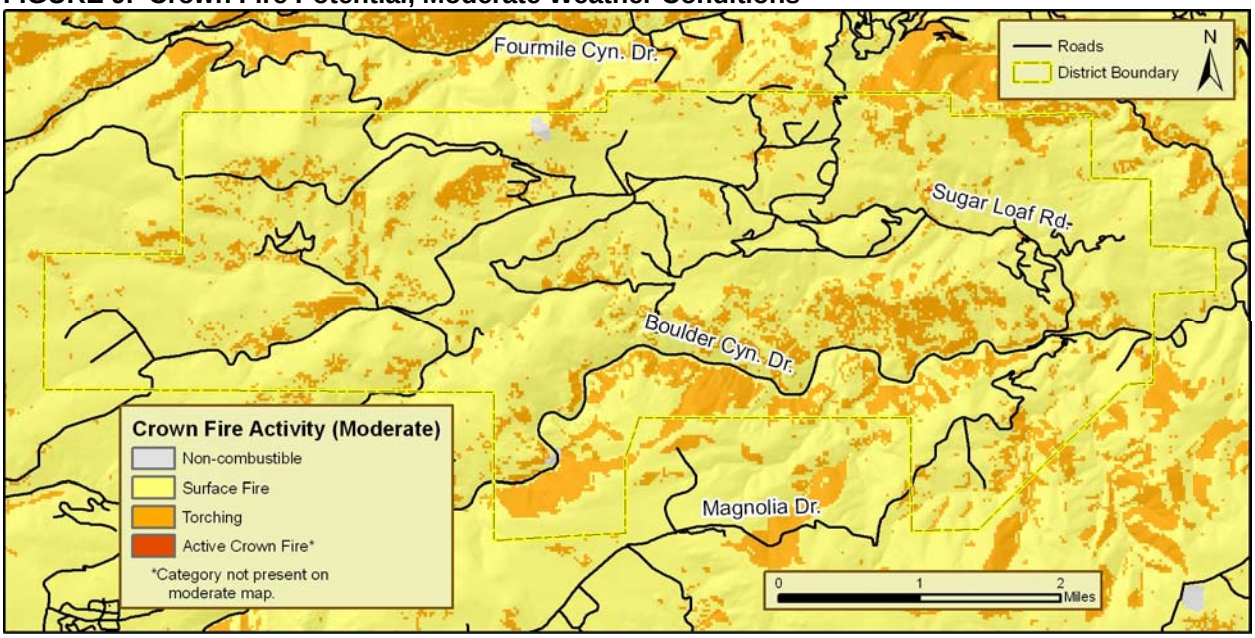


FIGURE 10. Flame Length, Extreme Weather Conditions

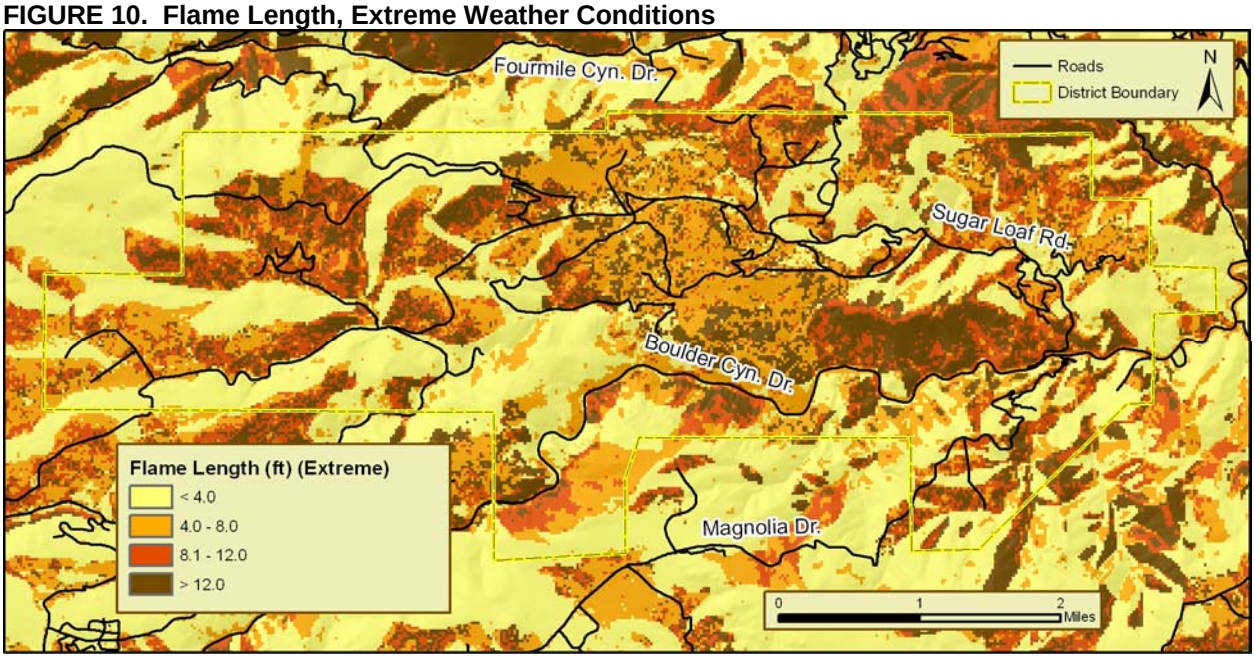


FIGURE 11. Rate of Spread, Extreme Conditions

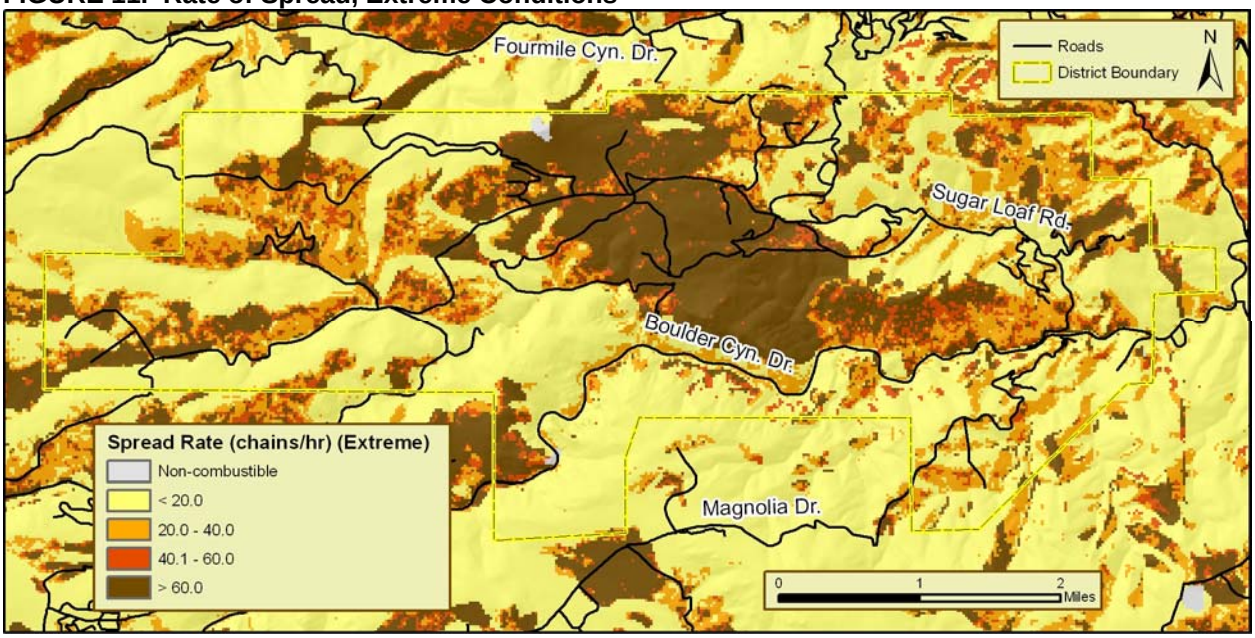
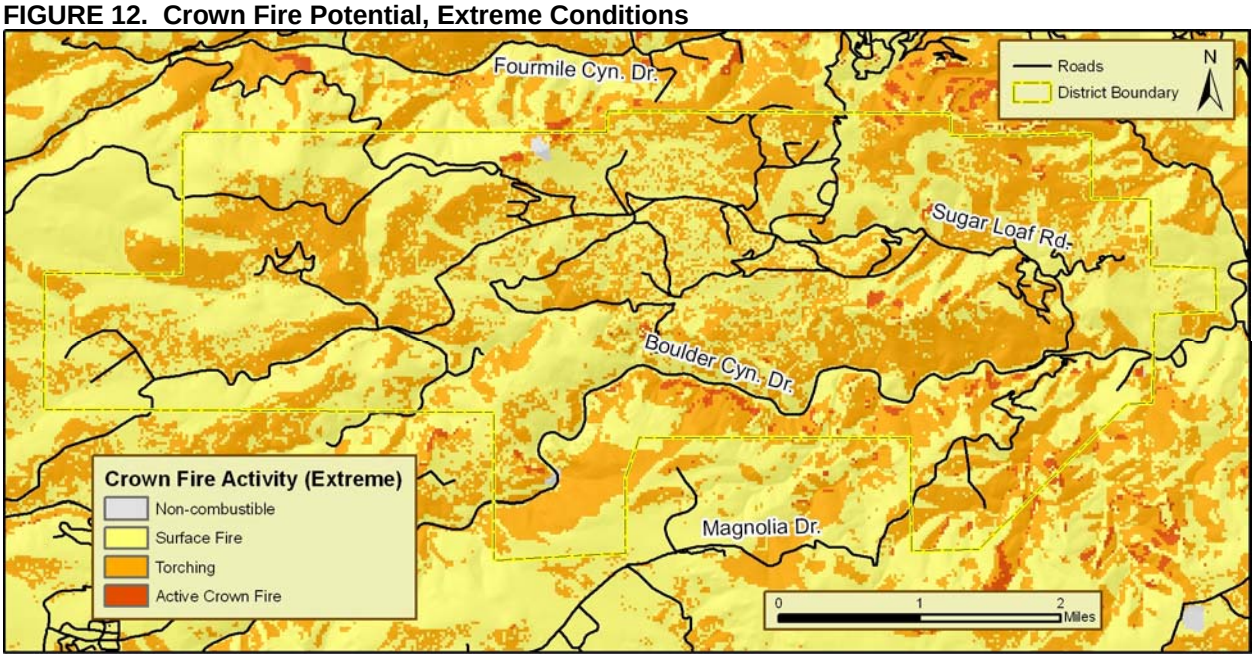


FIGURE 12. Crown Fire Potential, Extreme Conditions



SOLUTIONS AND MITIGATIONS

ESTABLISHING AND PRIORITIZING FIRE MANAGEMENT UNITS (FMUS)

An efficient method for prioritizing work efforts is to create FMUs. These units reflect a particular function, like developing an effective public outreach program, or a geographic treatment area, such as an area with related fuel reduction projects. FMUs are created prior to initiating management projects and mitigation activities. Unique activities and objectives are recommended for each unit. These solutions are designed to serve as proposed outlines for projects. They are presented as a starting point for communities to determine the priority and scope of the final project implementation. Local land and fire management agencies, with the input of the citizen's advisory council or fire safe council, must determine the final solutions.

The following FMUs have been identified for the SLFPD; recommendations are provided for each. FMUs are **not** ranked by priority, but priority recommendations have been provided for specific tactical mitigation actions where appropriate within FMUs.

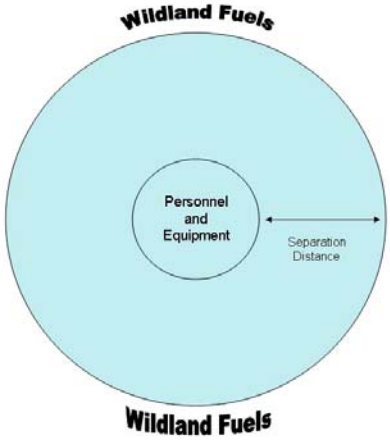
- Safety Zones, Addressing, Evacuation Routes, FMU
- Public Education FMU
- Local Preparedness and Firefighting Capabilities FMU
- Home Mitigation FMU
- Plains Communities FMU
- Fuels Modifications FMU
- Water Supply FMU

SAFETY ZONES, ADDRESSING, AND EVACUATION ROUTES FMU

When pre-planning for a wildfire incident, designating safety zones for use by the responding firefighters should be a top priority. More than one safety zone is advised, because fire operations can be spread out over a large geographical area. When evaluating areas to be used, they must be easily accessible and adhere to current guidelines recommended by NWCG (see **Figure 13).**

FIGURE 13. Safety Zone Guidelines

Flame Height	Distance Separation (firefighter to flame)	Area in Acres
10 feet	40 feet	1/10 acre
20 feet	80 feet	1/2 acre
50 feet	200 feet	3 acres
75 feet	300 feet	7 acres
100 feet	400 feet	12 acres
200 feet	800 feet	50 acres
(1 acre = 208 feet x 208 feet, or the approximate size of a football field)		



Distance separation is the radius from the center of the safety zone to the nearest fuels.[11]

RECOMMENDATIONS

There are numerous safety zone options located in the Sugarloaf communities. These areas should be evaluated by SLFPD personnel, and if viable inserted in the district's run books. Some larger ones are listed here.

- **East** – Betasso Water treatment plant
- **Central** – Lost Angel Road/Sugar Loaf road
- **West** – Sugar Loaf road/Coughlin Meadows road; Magnolia road/Twin Sisters road

ADDRESSING

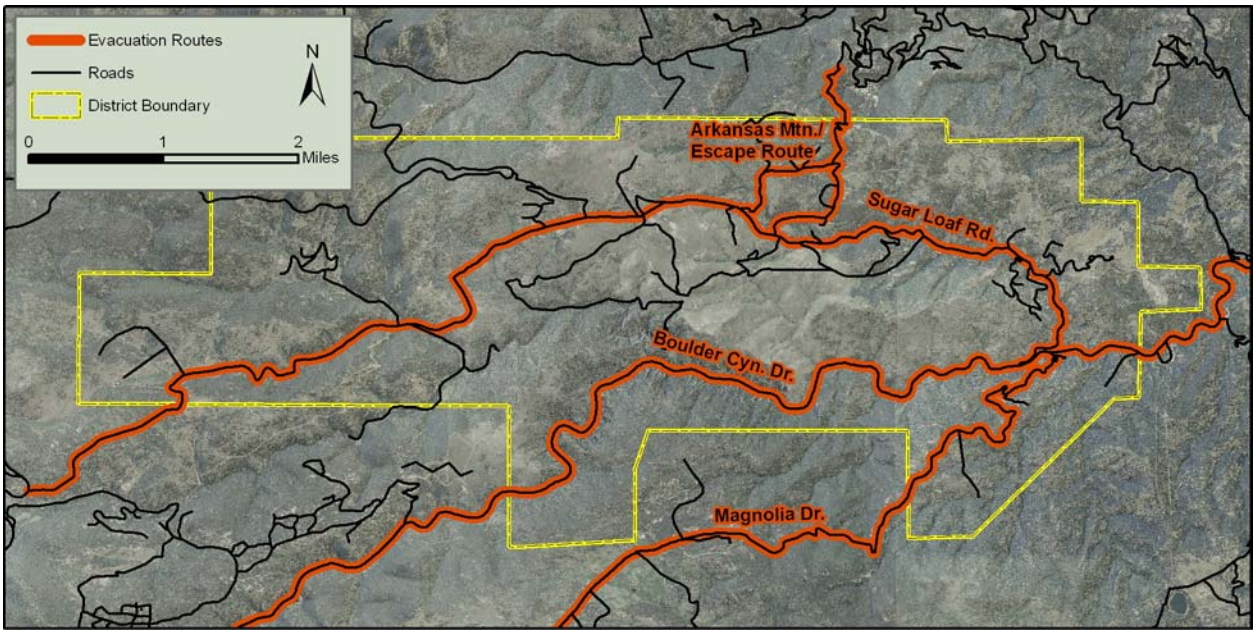
A number of areas within the SLFPD were found to have poor and/or inconsistent street signage and addressing of properties. In the worse cases, addressing was found to be missing altogether or attached to combustible objects. In mountain areas with intricate roads and driveways, proper standardized reflective signage is critical to effective response. The quicker response times that are achieved through proper addressing, especially at night and in difficult conditions, can make the difference between lives saved and lost. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps. This is especially true for volunteer operators who do not have the opportunity to train on access issues as often as career responders. Standardized reflective signage mounted on a non-combustible pole is highly recommended. These signs can be in addition to the current markers. Recommendations for address markers can be found in **Appendix D**.

11 http://www.nwcg.gov/pms/pubs/410-1/chapter01.pdf referenced March 20, 2007

EVACUATION ROUTES

There are three primary roads in the district: Sugar Loaf Road, Boulder Canyon, and Magnolia Road. These roads are all paved for the majority of the district. They are reasonably open and well maintained. These roads are all dual access with safety zones dispersed throughout and would allow safe egress during a fire event.

FIGURE 14. Evacuation Routes



EVACUATION ROUTE RECOMMENDATIONS

- **Magnolia Drive: Priority Level High.** This project focuses on opening up the Road for evacuation westward to Twin Sisters Road. Fuels mitigation consisting of limbing and thinning to reduce ladder fuels and create a safe, effective escape route is recommended. This project will require a cooperative effort between SLFPD and the Timberline FPD.

- **Boulder Canyon: Priority Level Moderate.** This project focuses on reducing decadent fuels along Boulder Creek. Removal of dead and down trees and slash along the creek below homes where feasible.

- **Arkansas Mountain/Escape Route: Priority Level Moderate.** This project focuses on improving roads for evacuation to Escape Route and Logan Mill road in Four Mile Canyon. See Access route project F.

OTHER ACCESS ROUTE RECOMMENDATIONS

- In order to reduce conflicts between evacuating citizens and incoming responders, it is desirable to have nearby evacuation centers for citizens and staging areas for fire resources. Evacuation centers should include heated buildings with facilities large enough to handle the population. Schools and churches are usually ideal for this purpose. Fire staging areas should contain large safety zones, a good view in the direction of the fire, easy access and turnarounds for large apparatus, a significant fuel break between the fire and the escape route, topography conducive to radio communications, and access to water. Local responders are encouraged to preplan the use of potential staging areas with property owners.

- Identify and pre-plan alternate escape routes and staging areas.

- Perform response drills to determine the timing and effectiveness of fire resource staging areas.

- Educate citizens on the proper escape routes and evacuation centers to use in the event of an evacuation.

- Continue to use Emergency Warning Evacuation (EWE) notice or call lists to warn residents when an evacuation may be necessary. Notification should also be carried out by local television and radio stations. The fire department website has good information. (http://www.slfpd.org/community.htm)

- Emergency management personnel should be included in the development of preplans for citizen evacuation.

- Post placards clearly marking “fire escape route.” This will provide functional assistance during an evacuation and communicate a constant reminder of wildfire to the community. Be sure to mount signage on non-combustible poles, preferably under the street name sign. The placards should start from the furthest point into the subdivision and work outward. These placards greatly assist responding firefighters from other agencies who may not be familiar with the layout of the subdivision.

PUBLIC EDUCATION FMU

Boulder County is experiencing continuing development. Rising property values and a limited number of building sites have resulted in recently constructed, high-value residences mixed in with older homes, rental properties and historic buildings in various states of decay. There is likely to be a varied understanding among property owners of the intrinsic hazards associated with building in these areas. An approach to wildfire education that emphasizes safety and hazard mitigation on an individual property level should be undertaken, in addition to community and emergency services efforts at risk reduction. Combining community values such as quality of life, property values, ecosystem protection and wildlife habitat preservation with the hazard reduction message will increase the receptiveness of the public.

Field contacts and interviews indicate that some homeowners in the study area are very supportive and proactive with regards to wildfire mitigation efforts. Unfortunately, in the foothill areas there are still homeowners and landowners who refuse to acknowledge the fact that they live in an area at risk of wildfires. Continued attempts to provide educational materials through personal contact should be conducted. Property owner education and the wildfire hazard mitigation message should be an ongoing.

RECOMMENDATIONS

- Visit these web sites for a list of public education materials, and for general homeowner education:
    - http://www.nwcg.gov/pms/pubs/pubs.htm
    - http://www.firewise.org
    - http://csfs.colostate.edu/protecthomeandforest.htm
    - http://www.slfpd.org
- Provide citizens with the findings of this study including:
    - Levels of risk and hazard
    - Values of fuels reduction programs
    - Consequences and results of inaction for ignitions within the community
- Create a Wildland Urban Interface (WUI) citizen advisory council to provide peer level communications for the community. Too often, government agency advice can be construed as self-serving. Consequently, there is poor internalization of information by the citizens. The council should be used to:
    - Bring the concerns of the residents to the prioritization of mitigation actions
    - Select demonstration sites
    - Assist with grant applications and awards

LOCAL PREPAREDNESS AND FIREFIGHTING CAPABILITIES FMU

The Sugar Loaf Fire Protection District (SLFPD) provides suppression services for the study area. The district has three fire stations: Station 1 is located at 1670 Lost Angel Road. Station 2 is located at 1360 Sugar Loaf Road. Station 3 is located at 8200 Sugar Loaf Road. Mutual aid is available from the Timberline Fire Authority, Four Mile Fire Protection District, Gold Hill Fire, Sunshine Fire Protection District, and Nederland Fire Protection District.

The SLFPD is served by an all volunteer department, which usually varies between 30 and 40 members. The SLFPD typically responds to approximately 110 calls each year, 2/3 of which are medical in nature, and 1/3 of which are more traditional fire calls.

SLFPD adheres to the National Wildfire Coordinating Group (NWCG) curriculum for training. Of SLFPD's, 32 members, 30 are firefighters with NWCG S-130/190 training (basic wildland fire fighting and weather). Approximately 2 firefighters are qualified at the Crew Boss/Engine Boss level or higher.

The SLFPD has 10 trucks located at 3 stations in the study area. SLFPD maintains two type-one engines, one type-2, two type-5 and one type-6 brush trucks, two type-3 (2,000 gallon) tenders and one type-2 (2,500 gallon) tender, and one medium rescue truck. For detailed information about each station and vehicle type, visit http://www.slfpd.org/stations.htm

FIGURE 15. Station 1 – 1670 Lost Angel Road

Engine 5501 **Brush 5531** **Tender 5541** **Tender 5544**

FIGURE 16. Station 2 – 1360 Sugar Loaf Road

Engine 5502 **Rescue 5522** **Brush 5532** **Tanker 5542**

FIGURE 17. Station 3 – 8200 Sugar Loaf Road

Engine 5503 **Brush 5533**

RECOMMENDATIONS

- Firefighter Training (**Priority Level High)**: Provide education and experience for all firefighters including:
- NWCG S-130/190 for all department members
- Annual wildland fire refresher and “pack testing” (physical standards test)
- S-215 Fire Operations in the Urban Interface
- S-290 Intermediate Fire Behavior
- I-200 and I-300 – Basic and Intermediate ICS
- Encourage personnel to seek higher wildfire qualifications
- Encourage personnel to participate in out of district wildfire assignments
- Encourage prescribed burn participation
- Encourage Type 3 incident management team participation and utilization

Equipment:

- **Priority Level High.** Provide minimum wildland Personal Protective Equipment (PPE) for all firefighters. (See NFPA Standard 1977 for requirements).

- **Priority Level High.** Provide gear bags for both wildland and bunker gear to be placed on apparatus responding to fire calls. This will help ensure that firefighters have both bunker gear and wildland PPE available when the fire situation changes.

- **Priority Level Moderate.** Provide and maintain a ten-person wildland fire cache in addition to the tools on the apparatus. The contents of the cache should be sufficient to outfit two squads for hand line construction and direct fire attack. Recommended equipment would include:

    - Four cutting tools such as pulaskis or super pulaskis
    - Six scraping tools such as shovels or combi tools
    - Four smothering tools such as flappers
    - Four backpack pumps with spare parts
    - Two complete sawyer’s kits including chainsaw, gas, oil, sigs, chaps, sawyer’s hard hat, ear protection, files, file guides, spare chains and a spare parts kit
    - MREs and clean drinking water sufficient for 48 hours

Communications:

- **Priority Level Moderate.** Secure additional VHF portable radios and batteries. These should be programmable. Training with these radios should be provided quarterly.

HOME MITIGATION FMU

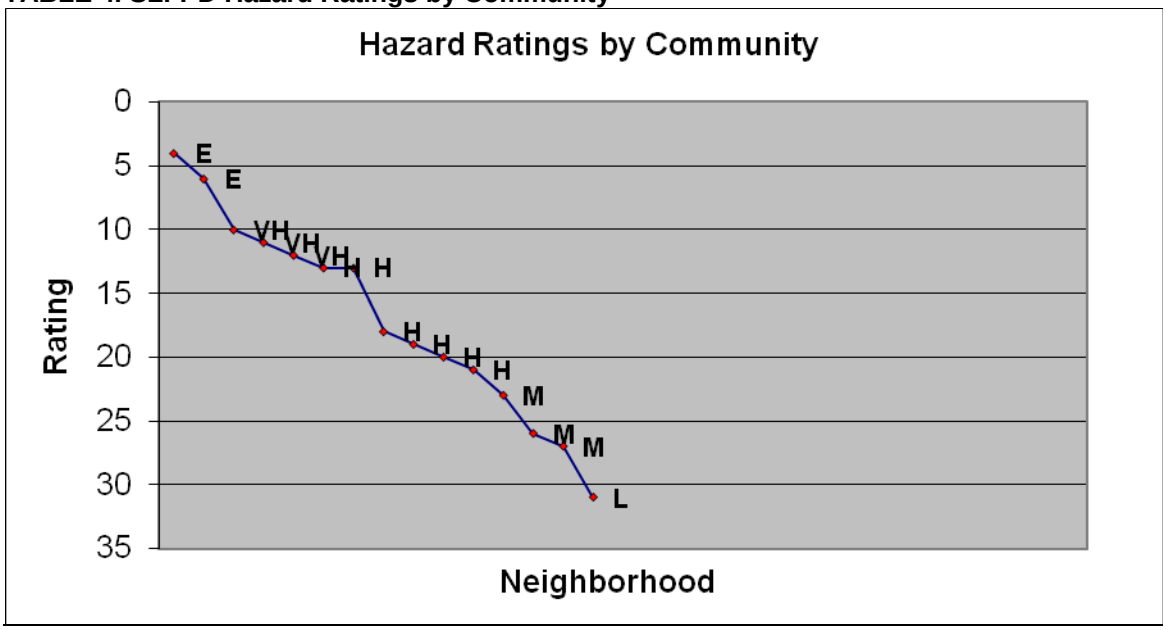
Community responsibility for self-protection from wildfire is essential. Educating homeowners is the first step in promoting a shared responsibility. Part of the educational process is defining the hazard and risks both at the community-level and parcel level.

The community-level assessment has identified 5 of the 15 communities in the study area to be at extreme or very high risk. Construction type, condition, age, the fuel loading of the structure/contents, and position are all contributing factors that make homes more susceptible to ignition, even under moderate burning conditions. There is also a likelihood of rapid fire growth and spread in these areas due to steep topography, fast burning or flashy fuel components, and other topographic features that contribute to channeling winds and the promotion of extreme fire behavior.

Table 4 illustrates the relative hazard rankings for communities in the study area.

- A rating of nine or less indicates an area of extreme hazard.
- A rating of 10 to 15 indicates a very high hazard.
- A rating of 16 to 20 indicates high hazard.
- A rating of 21 to 30 indicates moderate hazard.
- A rating of 30 or greater indicates a low hazard.

TABLE 4. SLFPD Hazard Ratings by Community



1. Old Whiskey / Magnolia	7. Mountain Meadows
2. Millionaire	8. Mountain King
3. Tall Timbers	9. Boulder Canyon
4. Swiss Peaks	10. Coughlin Meadows
5. Silver Springs	11. Old Post Office
6. Betasso / Broken Fence	13. Switzerland Park
7. Weaver	14. Lost Angel
XXXXXX	15. Silver Spruce

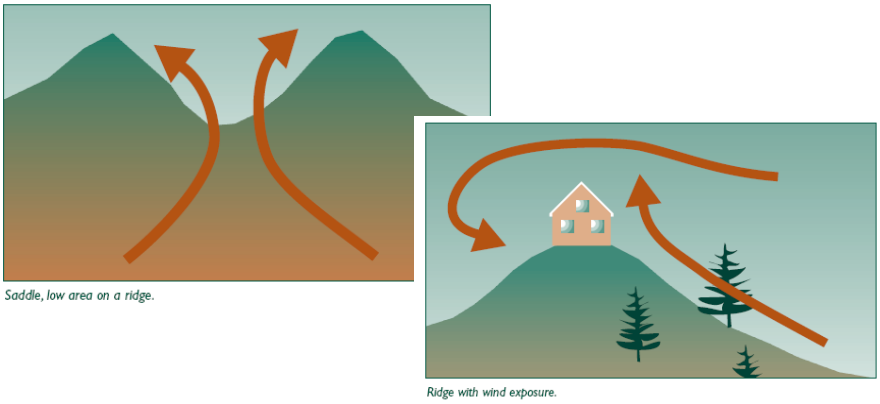
The communities with extreme and very high hazard ratings should be considered an FMU where a parcel level analysis should be implemented as soon as possible. Please see Appendix B for more detailed information.

Wildfire Preparedness

Residents of the district are encouraged to create survivable space around their homes by reducing vegetation and other material that could become fuel for a wildfire. Survivable space is different than defensible space because the goal of survivable space is to create an area around each home that will allow them to survive a wildfire without fire fighting resources defending each structure. Additional information about wildfire prevention is available from the FireWise Web site. Information about what to do before, during and after an emergency is available from the Boulder Community Network.

The most important element for the improvement of life safety and property preservation is for every home in the study area to have compliant, effective defensible and/or survivable space. This is especially important for homes with wood roofs and homes located on steep slopes, in chimneys, saddles, or near any other topographic feature that contributes to fire intensity.

FIGURE 18. Saddle & Ridge Top Development[12]



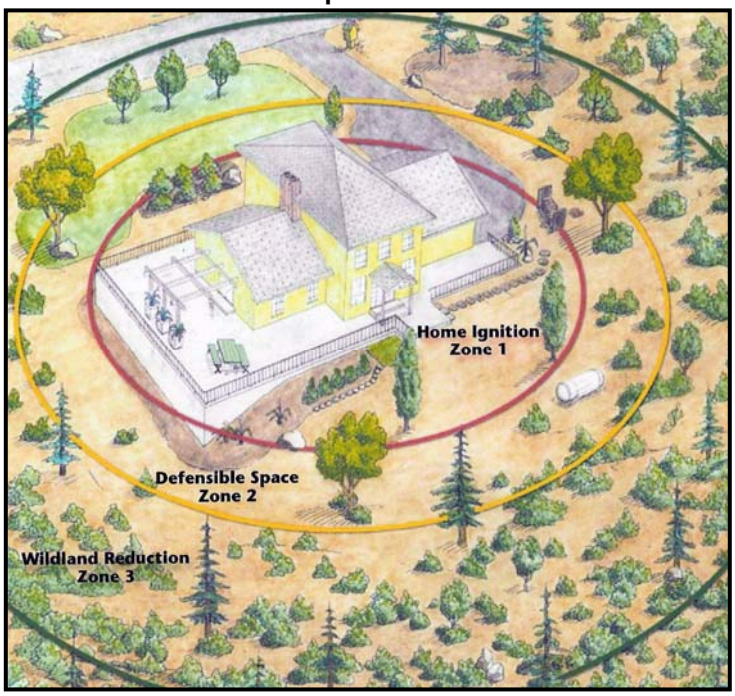
An aggressive program of evaluating and implementing defensible space for homes will do more to limit fire-related property damage than any other single recommendation in this report.

There is no question that any type of dense/flammable vegetation should be removed from around a home in order to reduce the risk of structural ignition during a wildfire. The question is how much should be removed. The basic rule is to eliminate all flammable materials (fire-prone vegetation, wood stacks, wood decking, patio furniture, umbrellas, etc.) from within 30 feet of the home. For structures near wildland open space, an additional 70 feet should be modified in such a way as to remove all dead wood from shrubbery, thin and trim trees and shrubs into "umbrella" like forms (lower limbs removed), and prevent the growth of weedy grasses (see **Figure 18**). Steep slopes and/or the presence of dangerous topographic features as described above may require the defensible space distances to be increased.

12 *FireWise Construction*, Peter Slack, Boulder Colorado

The term “clearance” leads some people to believe that all vegetation must be removed down to bare soil. This is not the case. Removing all vegetation unnecessarily compromises large amounts of forested terrain, increases erosion, and will encourage the growth of weeds in the newly disturbed soil. These weeds are considered “flashy fuels,” which actually increase fire risk because they ignite so easily. Defensible space must be ecologically sound, aesthetically pleasing, and relatively easy to maintain. Only then will the non-prescriptive use of fuels reduction around homes become commonplace.

FIGURE 19. Defensible Space Zones[13]



RECOMMENDATIONS

- **Priority level-High.** A parcel-level wildfire hazard analysis is recommended for the homes located in communities rated very high and extreme. This data should facilitate the following important fire management practices:
  - Establish a baseline hazard assessment for homes in these communities
  - Educate the community through the presentation of the parcel-level Hazard-Risk Analysis at neighborhood public meetings
  - Identify defensible space needs and other effective mitigation techniques
  - Identify and facilitate "cross-boundary" projects
  - Help the community to achieve national FIREWISE status

13 *A Homeowner's Guide to Fire Safe Landscaping*(2005) www.FireSafeCouncil.org

- Develop a Pre-Attack/Operational Plan for the entire study area. A pre-attack plan assists fire agencies in developing strategies and tactics that will mitigate incidents that occur.

- **Priority level-High.** Add reflective address signs at each driveway entrance to all homes. See **Appendix D** for recommendations.

- **Priority level-High**. Use the structure triage methodology provided in **Appendix C** to identify homes not likely to be defendable.

- **Priority level-Moderate**. Improve access roads and turnarounds to create safe access for firefighting resources. See **Appendix D** for recommendations.

FUELS MODIFICATION PROJECTS FMU

INTRODUCTION

One of the most effective forms of landscape scale fuels modification is the fuelbreak (sometimes referred to as "shaded fuelbreak"). A fuelbreak is an easily accessible strip of land of varying width, depending on fuel and terrain, in which fuel density is reduced, thus improving fire control opportunities. Vegetation is thinned, removing diseased, fire-weakened, and most standing dead trees. Thinning should select for the more fire-resistant species. Ladder fuels, such as low limbs and heavy regeneration, are removed from the remaining stand. Brush, dead and down materials, logging slash, and other heavy ground fuels are removed and disposed of to create an open park-like appearance. The use of fuelbreaks under normal burning conditions can limit the uncontrolled spread of fires and aid firefighters in slowing the spread rate. Under extreme burning conditions, where spotting occurs for miles ahead of the main fire, and probability of ignition is high, even the best fuelbreaks are not effective. Nonetheless, fuelbreaks have proven to be effective in limiting the spread of crown fires in Colorado.[14] Factors to be considered when determining the need for fuelbreaks in mountain subdivisions include:

- The presence and density of hazardous fuels
- Slope
- Other hazardous topographic features
- Crowning potential
- Ignition sources

With the exception of Aspen, all of Colorado's major timber types represent a significant risk of wildfire. Increasing slope causes fires to move from the surface fuels to crowns more easily, due to preheating. A slope of 30% causes the fire-spread rate to double when compared to the fire-spread rate (with the same fuels and conditions) on flat ground. Chimneys, saddles, and deep ravines are all known to accelerate fire spread and influence intensity. Communities with homes located on or above such features, as well as homes located on summits and ridge tops, are good candidates for fuel breaks. Crown fire activity values for Sugar Loaf were generated by the FlamMap model and classified into four standard ranges. In areas where independent and dependent crown fire activity is likely to exist, fuelbreaks should be considered. If there are known likely ignition sources (such as railroads and recreation areas that allow campfires) present in areas where there is a threat of fire being channeled into communities, fuelbreaks should be considered.

Fuelbreaks should always be connected to a good anchor point, like a rock outcropping, river, lake, or road. The classic location for fuelbreaks is along the tops of ridges, in order to stop fires from backing down the other side or spotting into the next drainage. This is not always practical from a WUI standpoint, because the structures firefighters are trying to protect are usually located at the tops of ridges or mid-slope. Mid-slope positioning is considered the least desirable for fuelbreaks, but it may be easiest to achieve as an extension of defensible space work or off existing roads and escape routes. One tactic would be to create fuelbreaks on slopes below homes located mid-slope and on ridge tops, so that the area of continuous fuels between the defensible space of homes and the fuelbreak is less than ten acres. Another commonly employed tactic is to position fuelbreaks along the bottom of slopes. It would make

14 Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" (Colorado State Forest Service, Colorado State University, 1983), p. 3.

sense to locate fuelbreaks mid-slope below homes to break the continuity of fuels into the smaller units mentioned above, even though this position is considered the least desirable from a fire suppression point of view.

Fuelbreaks are often easiest to locate along existing roadbeds (see the description of the fuels modification project for access routes on page 42 of this report). The minimum recommended fuelbreak width is usually 200 feet. As spread rate and intensity increases with slope angle, the size of the fuelbreak should also be increased, with an emphasis on the downhill side of the roadbed or centerline employed. The formulas for slope angles of 30% and greater are as follows: below road distance = 100' + (1.5 x slope %), above road distance = 100' – slope % (see **Table 4**). Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%.[15] Since fuelbreaks can have an undesirable effect on the aesthetics of the area, crown separation should be emphasized over stand density levels. In other words, isolating groupings rather than cutting for precise stem spacing will help to mitigate the visual impact of the fuelbreak.

In **Appendix B** we noted that some communities have done mitigation work and not removed the resulting debris. It is important to note that in Colorado's dry climate, slash decomposes very slowly. One consequence of failing to remove slash is to add to the surface fuel loading, potentially making the area more hazardous than before treatment. It is imperative that all materials be disposed of by piling and burning, chipping, physical removal from the area, or lopping and scattering. Of all of these methods lopping and scattering is the cheapest, but it is also the least effective, since it adds to the surface fuel load.

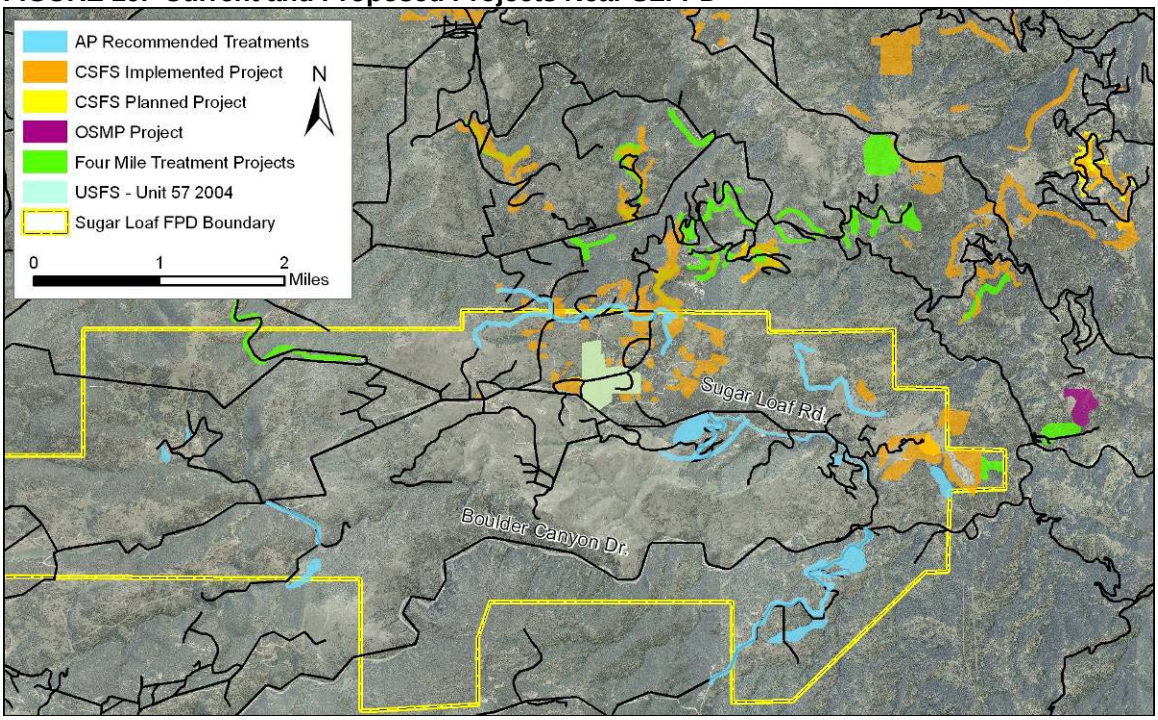
It is important to consider that fuelbreaks must be maintained to be effective. Thinning usually accelerates the process of regenerative growth. The effectiveness of the fuelbreak may be lost in as little as three to four years if ladder fuels and regeneration are not controlled.
One of the most difficult issues in establishing and maintaining fuelbreaks is securing the cooperation and participation of landowners. Ownership maps of the area indicate that implementation of fuels reduction projects recommended here would require the approval of public land management agencies as well as private landowners.

15 Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" (Colorado State Forest Service, Colorado State University, 1983), p. 11.

CURRENT AND PROPOSED CROSS-BOUNDARY PROJECTS

Numerous mitigation projects have been implemented or are planned, in and adjacent to the SLFPD. Where possible these have been leveraged with recommendations in this report to assure maximum benefit and efficiency. A significant amount of work has been implemented in the Mountain Meadows and Mountain King communities by both the USFS and CSFS. These projects were a great example of interagency cooperation. The community worked hand in hand with the agencies to get funding and implement the projects. The Unit 57 project was a 100 acre mechanical thinning treatment along Mountain Pines road. The Arkansas Mountain/Escape route mechanical thinning treatment (32 acres) helped tie together the work being done in Four Mile Fire District. Both of these projects contributed to lowering the hazard ratings of these communities. Left fork #1 was a mastication treatment on 28 acres along Dime road that included private and public lands. The Betasso Preserve area also had several projects implemented by the City and County. These fuels reduction treatments help to reduce the risk of fires from a high use recreation area.

FIGURE 19. Current and Proposed Projects Near SLFPD



ACCESS ROUTE FUELS MODIFICATION RECOMMENDATIONS

The communities in the study area would benefit from fuels reduction along their principal access routes. Thinning and limbing along primary access roads of the communities should include an area of at least 100' on either side of the centerline of the access routes, where practical. This distance should be modified to account for increased slope and other topographic features that increase fire intensity (see **Table 5**). This is especially important in communities with steep, narrow roads and few turnouts. In these areas, safer access for firefighters would make an impact on the number of structures that could be defended in a wildfire. Existing and natural barriers to fire should be incorporated into the project dimensions.

The cooperation of adjacent, contiguous landowners should be secured. If this is not possible, more intensive thinning may need to occur within the road easement. Landowner participation allows the project to be more flexible in selecting trees for removal. It allows greater consideration for the elements of visual screening and aesthetics. Enlarging the project dimensions allows more options for tree selection while still protecting the access/egress corridor.

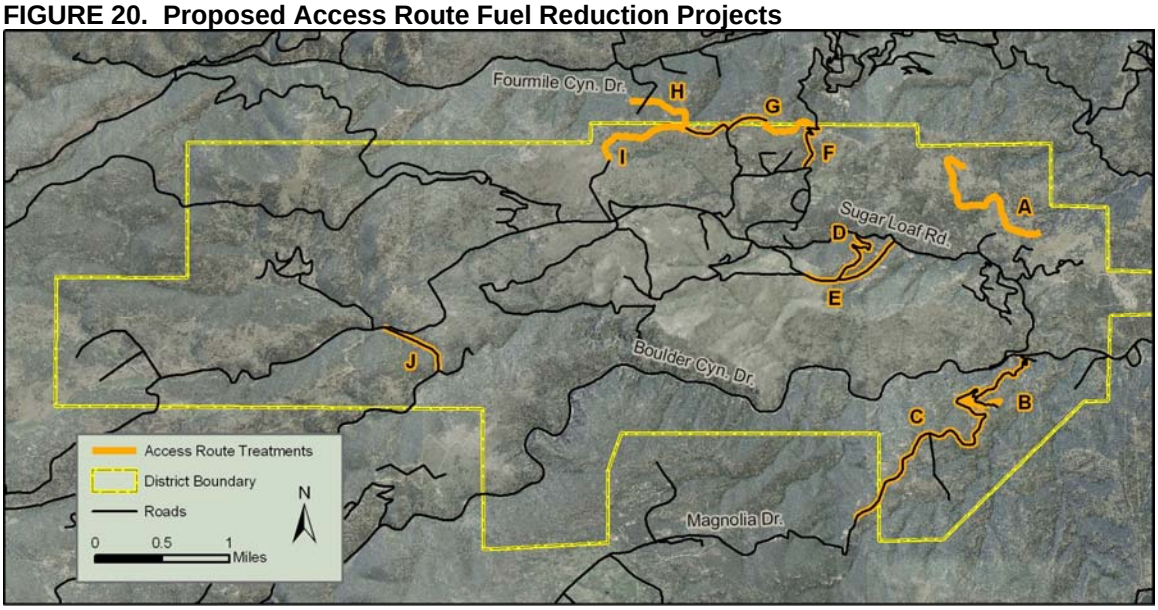
Elements of the fuels modification space for access and egress routes should include:

- Tree crown separation of at least 10' with groups of trees and shrubs interspersed as desired.
- Tree crown separation greater than 10' may be required to isolate adjacent groups or clumps of trees.
- Limb all remaining trees to a height of 8' or 1/3 of the tree height (whichever is greater).
- Clean up ground fuel within the project area.

TABLE 5. Recommended Treatment Distances For Mid-Slope Roads

% Slope	Distance Above Road	Distance Below Road
30	70 feet	145 feet
35	65 feet	153 feet
40	60 feet	160 feet
45	55 feet	168 feet
50	50 feet	175 feet

FIGURE 20. Proposed Access Route Fuel Reduction Projects



►PROJECTS

A. **Weaver Road Treatment (Approximately 1.5 miles) Priority level – High (see Figure 21).** This project focuses on limbing and thinning along Weaver road where fuels are present. Specifically, at 470 Weaver Road to reduce ladder fuels easterly to the Canyon Loop trail at Betasso Preserve. If combined with extended defensible space for nearby homes, this project will help protect a critical access route that will reduce time travel for supporting firefighting efforts at Betasso Preserve.

B. **Old Whiskey Trail Treatment (Approximately 0.5 miles) Priority Level – High (see Figure 21).** This project focuses on improving roads for evacuation to Magnolia Drive. Fuels mitigation consisting of limbing and thinning to reduce ladder fuels and create a safe, effective escape route is recommended. Areas where drainages cross the road should be thinned more substantially. If combined with extended defensible space for all homes, this project will help protect an important escape route.

C. **Magnolia Drive Evacuation Route Treatment (Approximately 3 miles) Priority Level – High.** See Evacuation routes pg XX

D. **Millionaire Drive E & W Treatments (Approximately 1 mile) Priority Level – High.** This project focuses on improving roads for evacuation to Sugar Loaf road. Fuels mitigation consisting of limbing and thinning to reduce ladder fuels and create a safe, effective escape route is recommended. Areas where drainages cross the road should be thinned more substantially. If combined with extended defensible space for all homes, this project will help protect an important escape route.

E. **Millionaire Drive E & W Emergency ConnectorsTreatments (Approximately 0.5 miles). Priority Level – High.** There is an existing semi-improved road from Lost Angel to Millionaire W and then continuing as a primitive two track road to Millionaire East. Improving these roads by clearing any obstructions, limbing of ladder fuels and possibly some grading is recommended. These would only need to be improved to the extent that a vehicle could reasonably drive on them during an emergency.

F. **Arkansas Mountain Road Treatment (Approximately 0.5 miles) Priority Level – Moderate.** This project focuses on improving roads for evacuation to Escape Route and Logan Mill road in Four Mile Canyon. Fuels mitigation consisting of limbing and thinning along the road to reduce ladder fuels and create a safe, effective escape route is recommended. If combined with existing extended defensible space and fuels mitigation already completed, this project will help protect an important escape route.

G. **Left Fork road Emergency Connector Treatments (Approximately 0.8 miles) Priority Level – High.** There is an existing semi-improved road from Left Fork road to Arkansas Mountain road. Improving this road by clearing any obstructions, limbing of ladder fuels and possibly some grading is recommended. This would only need to be improved to the extent that a vehicle could reasonably drive on them during an emergency.

H. **Mountain King Road Treatment (Approximately 1 mile) Priority Level – Moderate.** This project focuses on improving evacuation to Left Fork and Mountain Pines road. Fuels mitigation consisting of limbing and thinning along the road to reduce ladder fuels and create a safe, effective escape route is recommended. If combined with existing extended defensible space and fuels mitigation already completed, this project will help protect an important escape route.

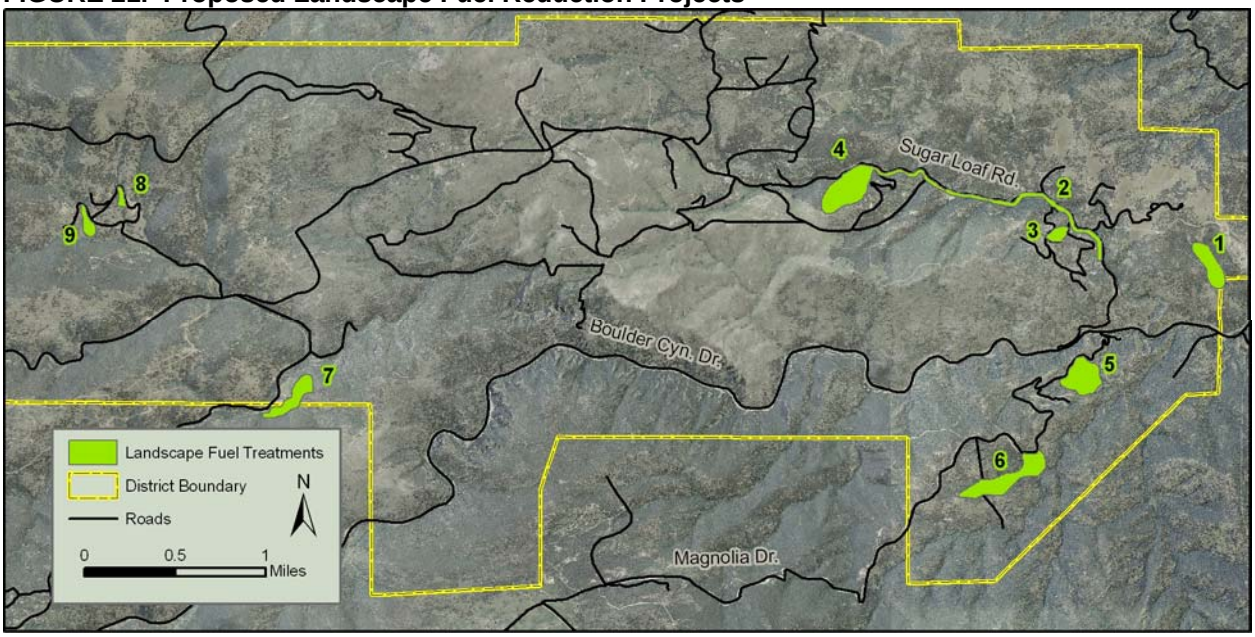
I. **Mountain King road Emergency Connector Treatments (Approximately 1 mile) Priority Level – High.** There is an existing semi-improved road from Mountain King road to Labelle road. Improving this road by clearing any obstructions, limbing of ladder fuels and possibly some grading is recommended. This would only need to be improved to the extent that a vehicle could reasonably drive on them during an emergency.

J. **Switzerland Park Road Treatment (Approximately 0.5 miles) Priority Level – High.** This project focuses on improving evacuation to Sugar Loaf road. Fuels mitigation consisting of limbing and thinning along the road to reduce ladder fuels and create a safe, effective escape route is recommended. This road has a very narrow intersection with Dream Canyon where fuel loading is high.

PROPOSED LANDSCAPE FUELS REDUCTION PROJECTS FOR SLFPD

The following recommendations are in addition to, not in place of, the fuels reductions mentioned in the **other FMUs**. It is important to note that the boundaries shown on the maps in this document are only approximate. Exact boundaries will be determined when treatment agreements are negotiated with the involved land owners and/or land managers.

FIGURE 21. Proposed Landscape Fuel Reduction Projects



►►PROJECTS

1. **Betasso/Boulder Canyon Link Trail Treatment (approximately 10 acres). Priority level – Moderate**. This project is already in progress as is evident from the marked trees. It is recommended that this project be completed in a timely manner. The slash that has been generated from past cutting has been piled in the drainage and should be removed.
2. **Sugar Loaf Road #1 Treatment (Approximately 16.3 Acres). Priority Level – Moderate.** This project begins below Kelly Road East and extends west along Sugar Loaf Road to Millionaire Drive East. Thinning should be conducted along the road to conform to the shaded fuelbreak guidelines described above. If combined with defensible space for all homes, this project will help protect the Tall Timbers community from a fire start on Sugar Loaf road making a significant run upslope into the community.
3. **Douglas Court Treatment (Approximately 4.6 Acres). Priority Level – High.** This project is located between Kelly Road East and West and Douglas Court that focuses on a drainage with a heavy fuel load that runs through the middle of the community. Thinning should be conducted to conform to the shaded fuelbreak guidelines described in the above. If combined with defensible space for all homes, this treatment will help to protect the upper areas of the subdivision.

4. **Sugar Loaf Road #2 Treatment (Approximately 34 Acres). Priority Level – High.** This project begins below Millionaire Drive East and extends west along Sugar Loaf Road beyond Millionaire Drive West. Thinning should be conducted along the road to conform to the shaded fuelbreak guidelines described above. It is also recommended that thinning be continued further up into the drainage west of Millionaire Drive West. If combined with defensible space for all homes, this project will help protect the Millionaire Drive community from a fire start on Sugar Loaf road making a significant run upslope into the community.
5. **Hawkins Gulch Treatment (Approximately 20.5 Acres). Priority Level – High.** This project would remove the heavy fuels at the mouth of Hawkins Gulch. This is a classic fire "chimney" that greatly increases fire intensity and rate of spread. It should be mitigated to the extent possible. There are heavy fuels especially on the south side of the drainages that should be the focus of the mitigation work. This is a critical project to help protect the Old Whiskey Trail communities.
6. **Keystone Gulch Treatment (Approximately 26.6 Acres). Priority Level – Moderate.** This project would remove the heavy fuels midslope up Keystone Gulch. This is another classic fire "chimney" that greatly increases fire intensity and rate of spread. It should be mitigated to the extent possible. There are heavy fuels especially on the south side of the drainages that should be the focus of the mitigation work. This and the Hawkins Gulch project both need to be completed to help protect the Old Whiskey Trail communities.
7. **Switzerland Park Treatment (Approximately 14.2 Acres). Priority Level – Moderate.** This project focuses on limbing and thinning on the south side of the meadow on the hillside. The thinning should be conducted to conform to the shaded fuelbreak guidelines described in the above. If combined with defensible space for all homes, this project will help protect the community from embers and radiant heat generated from an ignition on the hillside or from a grass fire in the meadow spreading into the canopy and up the steep hillside.
8. **Nightshade Drive Treatment (Approximately 2.2 Acres). Priority Level – Moderate.** This project focuses on reducing the fuel load in the drainage that crosses Nightshade Drive at the hairpin (388 Nightshade) Thinning should be conducted to conform to the shaded fuelbreak guidelines described above. If combined with defensible space for all homes, this project will help protect the evacuation route, as well as breaking the continuity of fuels across the road. This drainage is in line with the slope and would burn intensely, spreading embers to homes and landscape above the road.
9. **Primos Road Treatment (Approximately 5 Acres). Priority Level – Moderate.** This project is similar to the Nightshade Drive treatment. Begin behind 929 Primos road and continue north in the drainage to 1051 Primos Road. Thinning should be conducted to conform to the shaded fuelbreak guidelines described above. If combined with defensible space for all homes, this project will help protect the road during evacuation, as well as, breaking the continuity of fuels below the homes. This drainage is in line with the slope and would burn intensely, spreading embers to homes and landscape above the road.

AREAS OF SPECIAL INTEREST

Watersheds
Like most western communities, Boulder depends on stored water most of the year. High streamflows from melting snowpack occur for only a few spring and summer months. Natural streamflows in late summer and the winter are not sufficient to meet customer demands and must be supplemented with previously stored water supplies. The amount of water available also changes from year to year, depending on how much snow falls in the mountains.

Therefore, Boulder must store water in reservoirs during wetter years to carry over for use in dry years. The City owns seven reservoirs and several natural lakes in the headwaters of the North Boulder Creek basin within the Silver Lake Watershed. In addition, the city owns Boulder Reservoir northeast of Boulder and the Barker Reservoir facilities on Middle Boulder Creek. There are several reservoirs and natural lakes within the city-owned Silver Lake Watershed at the headwaters of North Boulder Creek just below the continental divide. Barker Reservoir is an 11,700 acre-foot reservoir near Nederland.[16]

A wildfire could have a very serious impact on the water quality and infrastructure of these watersheds. Some of the immediate concerns would be erosion, sedimentation and water contamination. Long term issues would be increased run off, soil retention and loss of snowpack from exposure. There would be a significant fiscal impact as well.

Smaller drainages such as the Bummer's Gulch Drainage, Gordon Gulch Drainage, North Boulder Creek and Boulder Falls (an extremely high use recreation area), as well as the main fork of Boulder Creek and Highway 119, are affected in a similar fashion. While they may not have an impact on the water supply of the city, they would affect local water sources and stream flows. All of the Sugarloaf tributaries drain into Boulder Creek – an important recreational area, trout fishery, and water source for downstream communities. The Black Tiger Fire led to serious sedimentation and erosion issues for several years, compromising the water quality of Boulder Creek. Finally, if a fire were to modestly cross fire protection district lines, areas such as Pennsylvania Gulch would be rapidly compromised, causing extreme harm to Four Mile Creek, another major tributary of Boulder Creek.

[16] Source Water Master Plan. Referenced 8/21/07

WATER SUPPLY FMU

Water is a critical fire suppression issue in the SLFPD study area, as in many of the areas of Colorado's Front Range. While there are numerous water sources throughout the district, they are not always reliable or accessible. Some are not of adequate size and some are located a fair distance from communities. This is an ongoing challenge for firefighters. Every opportunity to add additional cisterns in communities should be explored.

Water supplies currently used by SLFPD are shown in **Figure 22**. A brief description of these water sources is given in **Table 6**.

FIGURE 22. SLFPD Water Sources

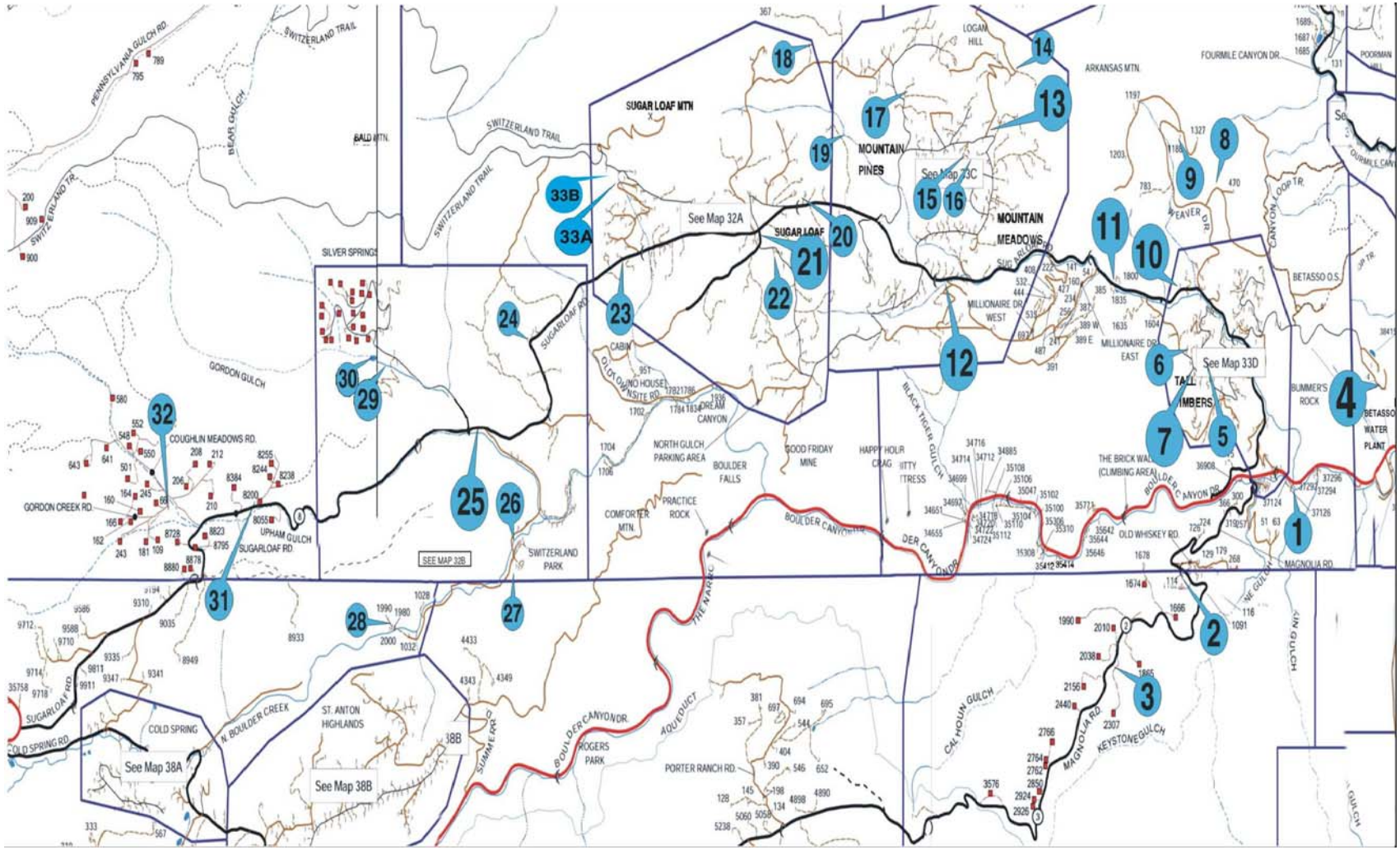


TABLE 6. SLFPD Water Sources

Map Key	Common Name	ADDRESS	Capacity (gal.)	Location	Access	Notes/Com-binations
1	**Barnes' Pond**	**37126 Boulder Canyon**	**Continuous**	Driveway on S side of Canyon.	**Good**	**Down concrete ramp E of drive**
2	**900 Magnolia Rd Tank**	900 Magnolia Rd	10,000	Beside driveway	**Good**	**Into driveway, truck turnaround at cistern**
3	**2307 Magnolia Rd Tank**	**2307 Magnolia Rd**	**10,000**	**W side - 50 ft from Magnolia**	**Good**	**Turnaround available**
4	**Betasso**	**Betasso treatment plant**	**Continuous**	**South hydrant**	**Gate**	**Code:**
5	Kugle's Swimming Pool	84 Douglas Court	10,000	40 ft. from driveway		Private--Emergency only
6	Sandy Drive Pool	210 Sandy Drive	9,000	Far from driveway		Private--Emergency only
7	**Sandy Drive Tank**	**Sandy Drive & Kelly Rd W**	**10,000**	**E side of Sandy Drive**	**Excellent**	**On the left going up Sandy Dr.**
8	**470 Weaver Drive**	470 Weaver Dr.	16,000	Driveway	**Excellent**	Before "2 trees"
9	1188 Weaver Drive	1188 Weaver Dr.	12,000	S side of rd. E of house	Good	
10	**Station #2 (La Hue Cistern)**	**1360 Sugar Loaf Road**	**10,000**	**W of station 2**	**Excellent**	**Open gate valve at top of stairs**
11	**Sweeny's Mill Pond**	**1800 Sugar Loaf Road**	**80,000**	**N. side of SL Rd.**	**Excellent**	
12	**The Duck Pond**	**2941 SL Rd.**	**29,000+**	**S. Side SL Rd.**	**Excellent**	**Hydrant 300' E. of pond. ~15psi**
13	**Arkansas Mtn. Rd. Tank**	**~20 Arkansas Mtn. Rd**	**10,000**	**East side of Rd**	**Excellent**	
14	Bray's Cistern	595 Arkansas Mtn. Road	1,800		Good	Private--Emergency only
15	**Mountain Pines Cistern**	**1105 Mountain Pines Rd.**	**8,000**	**300 ft S of Mtn Pines Rd.**	**Good**	**On private land**
16	Hunter's Pond	1105 Mountain Pines Rd.	10,000	Ask owner for details	Poor	Private--Emergency only
17	Neitenbach's Pond	252 Left Fork	40,000	E side of Rd	Good	Narrow entry into driveway. May be dry.
18	Chamberlin's Cistern	359 Mountain King Road	1,800	In driveway, east side	Poor	Private—Emergency only

19	Poltzer's Pond	3660 Sugar Loaf Rd	25,000		**Bad**	Private-- Emergency only
20	4-Mile Marker Tank	3962 Sugar Loaf Road	8,000	Private drive. N side of SL Rd.	Good	Blow out pipe – possible silt buildup
21	**Old Town Site**	**10 Old Town Site Rd**	**Continuous 40 psi**	**East side old town site Rd.**	**Excellent**	**NO clear suction hose allowed**
22	Station #1 Tank	1677 Lost Angel Road	5,000	E of building	Good	
23	**5-Mile Marker Tank**	**5155 Sugar Loaf Road**	**12,000**	**S side of Sugar Loaf**	**Excellent**	**20 ft from rd.**
24	Wither's Corner Pond	5750 Sugar Loaf Road	8,000	N side of SL Rd.	Good	May be dry
25	**PRIMOS**	**S.L.Rd & Primos Rd**	**Continuous 65 psi**	**N side Sugar Loaf Rd.**	**Excellent**	**NO clear suction hose allowed**
26	**Switzerland Park dry hydrant**	**801 Switzerland Park Road**	**Continuous**	**Before Bridge**	**Excellent**	**May be frozen in winter**
27	Switzerland Park Pond	901 Switzerland Park Road	0 - 30,000	S side of Sw Park Clubhouse (#903)	Poor	Usually dry
28	Winchester's House	2000 Switzerland Park Road	Stream stand pipe		Poor	May be frozen in winter
29	**Silver Springs Pond #1**	**579 Primos Road**	**40,000**	Driveway on W of Primos Rd.	**Good**	**No turn around. Blow out Pipe**
30	Silver Springs Pond#2	581 Primos Road	1.0 Mil	W side of Primos Rd.	Poor	No dry hydrant. **Caution** Access across field- may be wet
31	**Station #3 Pond**	**8200 S.L. Rd**	**84,000**	**W of station building**	**Excellent**	
32	**Coughlin Meadows Tank**	**~51 Gordon Creek Rd.**	**10,000**	**SE of road**	**Excellent**	
33A	**Swiss Peaks, Wet hydrant**	**697 south Peak Rd**	**10,000 ~50 psi**	**West of road**	**Excellent**	**Access from SL Mtn Rd**
33B	**Swiss Peaks, Same tank, dry hydrant**	**681 SL Mtn Rd**	**10,000**	**~100' SW of road**	**Good**	**Poor access when snowy**

GLOSSARY

The following definitions apply to terms used in the Sugarl Loaf Fire Protection District Community Wildfire Protection Plan.

1 hour Timelag fuels: Grasses, litter and duff; <1/4 inch in diameter.

10 hour Timelag fuels: Twigs and small stems; ¼ inch to 1 inch in diameter.

100 hour Timelag fuels: Branches; 1 to 3 inches in diameter.

1000 hour Timelag fuels: Large stems and branches; >3 inches in diameter.

Active Crown Fire: A crown fire in which the entire fuel complex – all fuel strata – become involved, but the crowning phase remains dependent on heat released from the surface fuel strata for continued spread (also called a Running Crown Fire or Continuous Crown Fire).

ArcGIS 9.x: Geographic Information System (GIS) software designed to handle mapping data in a way that can be analyzed, queried, and displayed. ArcGIS is in its ninth major revision and is published by the Environmental Systems Research Institute (ESRI).

Crown Fire (Crowning): The movement of fire through the crowns of trees or shrubs, which may or may not be independent of the surface fire.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or from the structure. The design and distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure.

Energy Release Component: An index of how hot a fire could burn. ERC is directly related to the 24-hour, potential worst case, total available energy within the flaming front at the head of a fire.

Extended Defensible Space (also known as Zone 3): A defensible space area where treatment is continued beyond the minimum boundary. This zone focuses on forest management with fuels reduction being a secondary consideration.

Fine Fuels: Fuels that are less than ¼ inch in diameter such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which, when dry, ignite readily and are consumed rapidly.

Fire Behavior Potential: The expected severity of a wildland fire expressed as the rate of spread, the level of crown fire activity, and flame length. Fire Behavior Potential is derived from fire behavior modeling programs using the following inputs: fuels, canopy cover, historical weather averages, elevation, slope, and aspect.

Fire Danger: Not used as a technical term in this document due to various and nebulous meanings that have been historically applied.

Fire Hazard: Given an ignition, the likelihood and severity of Fire Outcomes (Fire Effects) that result in damage to people, property, and/or the environment. Fire Hazard is derived from the Community Assessment and the Fire Behavior Potential.

Fire Mitigation: Any action designed to decrease the likelihood of an ignition, reduce Fire Behavior Potential, or to protect property from the impact of undesirable Fire Outcomes.

Fire Outcomes (aka Fire Effects): A description of the expected effects of a wildfire on people, property, and/or the environment based on the Fire Behavior Potential and physical presence of Values at Risk. Outcomes can be desirable as well as undesirable.

Fire Risk: The probability that an ignition will occur in an area with potential for damaging effects to people, property, and/or the environment. Risk is based primarily on historical ignitions data.

Flagged Addressing: A term describing the placement of multiple addresses on a single sign, servicing multiple structures located on a common access.

FlamMap: A software package created by the Joint Fire Sciences Program, Rocky Mountain Research Station. The software uses mapped environmental data such as Elevation, Aspect, Slope, and Fuel Model, along with fuel moisture and wind information, to generate predicted fire behavior characteristics such as Flame Length, Crown Fire Activity, and Spread Rate.

Flame Length: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface) – an indicator of fire intensity.

FMU (Fire Management Unit): A method of prioritizing fire mitigation work efforts. Units can be defined by function (e.g., public education efforts) or geography (e.g., fuel reduction projects in a given area).

Fuelbreak: A natural or constructed discontinuity in a fuel profile used to isolate, stop, or reduce the spread of fire. Fuelbreaks may also make retardant lines more effective and serve as control lines for fire suppression actions. Fuel breaks in the WUI are designed to limit the spread and intensity of crown fire activity.

ICP (Incident Command Post): The base camp and command center from which fire suppression operations are directed.

ISO (Insurance Standards Office): A leading source of risk information to insurance companies. ISO provides fire risk information in the form of ratings used by insurance companies to price fire insurance products to property owners.

Jackpot Fuels: a large concentration of discontinuous fuels in a given area such as a slash pile.

Passive Crown Fire: a crown fire in which individual or small groups of trees torch out (candle), but solid flaming in the canopy fuels cannot be maintained except for short periods.

Shelter-in-Place Areas: A method of protecting the public from an advancing wildfire by instructing people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to hazardous materials incident response,

where time, hazards, and sheer logistics often make evacuation impossible. This concept is the dominant modality for public protection from wildfires in Australia where fast moving, short-duration fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed preplan which takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior. For a more complete discussion of the application and limitations of shelter-in-place concepts see the **Addressing, Evacuation, and Shelter-In-Place FMU** section of this report.

Slash: Debris left after logging, pruning, thinning, or brush cutting; includes logs, chips, bark, branches, stumps, and broken understory trees or brush.

Spotting: Behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Structural Triage: The process of identifying, sorting, and committing resources to a specific structure.

Surface Fire: A fire that burns on the surface litter, debris, and small vegetation on the ground.

Timelag: Time needed under specified conditions for a fuel particle to lose 63 percent of the difference between its initial moisture content and its equilibrium moisture content.

Values at Risk: People, property, ecological elements, and other human and intrinsic values within the project area. Values at Risk are identified by inhabitants as important to the way of life of the study area and are specifically susceptible to damage from undesirable fire outcomes.

WHR (Community Wildfire Hazard Rating. AKA Community Assessment): A fifty-point scale analysis designed to identify factors which increase the potential for and/or severity of undesirable fire outcomes in WUI communities.

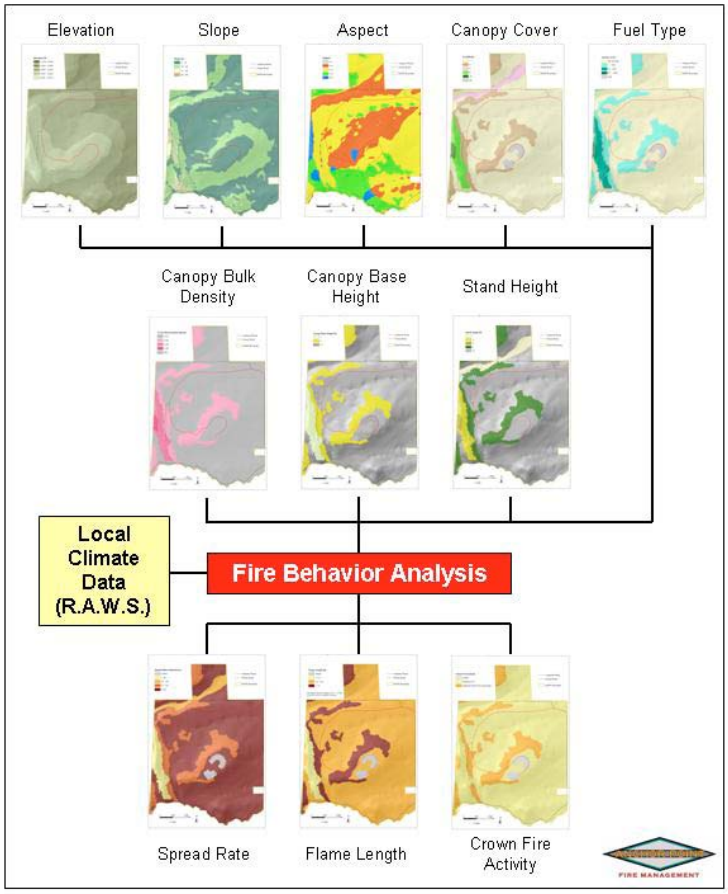
WUI (Wildland Urban Interface): The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Sometimes referred to as Urban Wildland Interface, or UWI.

APPENDIX A
FIRE BEHAVIOR POTENTIAL ANALYSIS METHODOLOGY

PURPOSE

The purpose of this document is to describe the methodology used to evaluate the threat represented by physical hazards – such as fuels, weather and topography – to Values at Risk in the study area, by modeling their effects on fire behavior potential.

Figure 1. Flow Chart



The fire behavior potential analysis reports graphically the probable range of spread rate, flame length, and crown fire potential for the study area, based upon a set of inputs significant to fire behavior. The model inputs include aspect, slope, elevation, canopy cover, fuel type, canopy bulk density, canopy base height, stand height, and climate data. The model outputs are determined using FlamMap[1], which combines surface fire predictions with the potential for crown fire

[1] Mark Finney, Stuart Brittain and Rob Seli. The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana), the Bureau of Land Management and Systems for Environmental Management (Missoula, Montana).

development. Calculations for surface fire predictions (rate of spread and flame length) are based on the USDA Forest Service's BEHAVE[2] model.

BEHAVE

The BEHAVE fire behavior prediction and fuel modeling system was employed to determine surface fire behavior estimates for this study. BEHAVE is a nationally recognized set of calculations used to estimate a surface fire's intensity and rate of spread given certain conditions of topography, fuels, and weather. The BEHAVE modeling system has been used for a variety of applications, including prediction of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, and fire prevention planning and training. Predictions of wildland fire behavior are made for a single point in time and space, given simple user-defined fuels, weather, and topography. Requested values depend on the modeling choices made by the user.

Assumptions of BEHAVE:

- Fire is predicted at the flaming front
- Fire is free burning
- Behavior is heavily weighted towards the fine fuels
- Continuous and uniform fuels
- Surface fires

FlamMap

Anchor Point uses FlamMap to evaluate the potential fire conditions in the fire behavior study area. The Sugar Loaf study area encompasses 11,007 ares. The study area for the fire behavior analysis covers approximately 24,854 acres. The area shown in the graphics contained herein represents the study area plus a half-mile buffer in all directions. The use of this buffer provides the user with an analysis of potential fire behavior on adjacent lands. From both a planning and tactical perspective, it is important to evaluate exposures beyond the area of interest.

The study area is broken down into grid cells of 10-meters per side (10M). Using existing vector and raster spatial data and field data, ArcGIS spatial analysis capabilities are used to calculate model inputs for each 10M cell. These values are input into FlamMap, along with reference weather and fuel moisture (long-term weather observations statistically calculated from the Sugar Loaf Remote Automated Weather Station information). The outputs of FlamMap include the estimated Rate of Spread (ROS) (from BEHAVE), Flame Length (FL) (from BEHAVE) and Crown Fire Activity for a fire in that 10M cell. The model computes these values for each cell in the study area independently, so the data in each cell is unaffected by adjacent cells.

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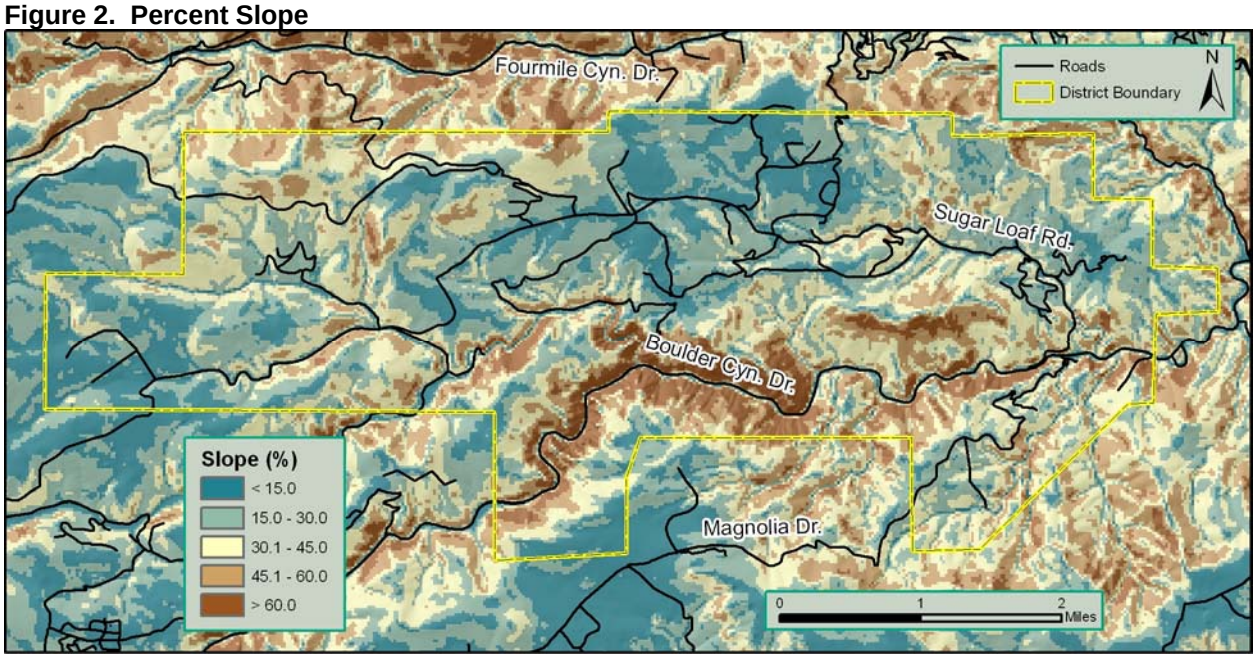
[2] Patricia L. Andrews, producer and designer, Collin D. Bevins, programmer and designer, The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana) and Systems for Environmental Management (Missoula, Montana).

FIRE BEHAVIOR INPUTS

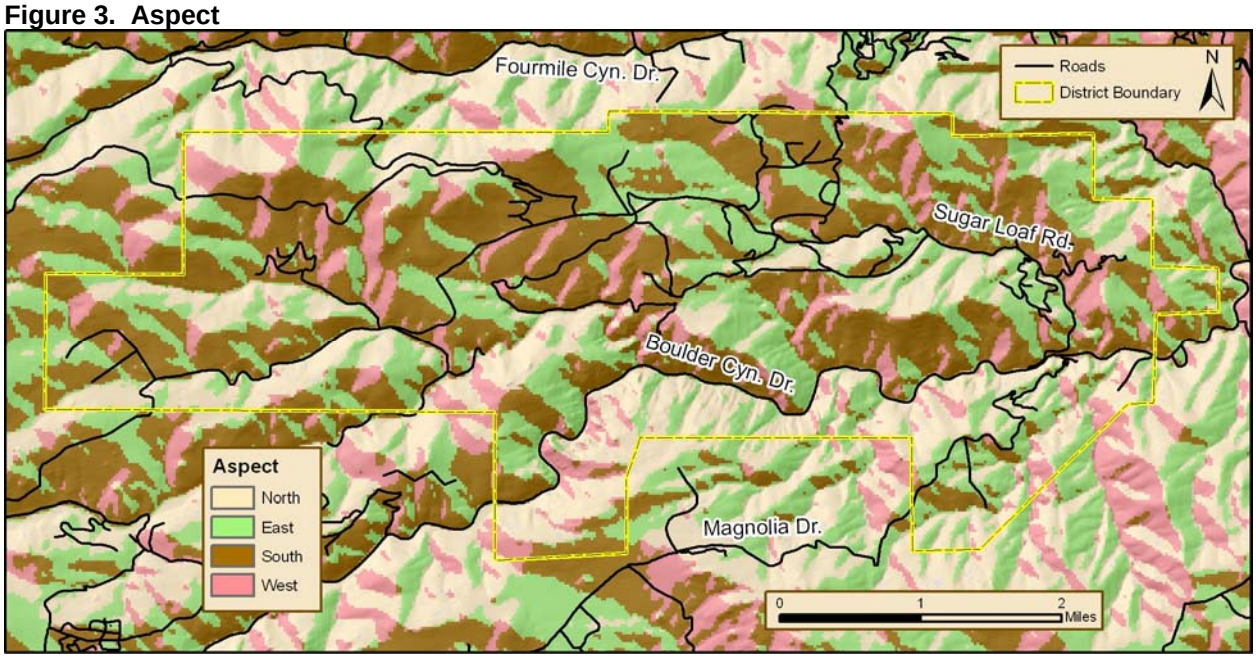
The major factors influencing fire behavior are fuels (type and coverage), weather, and topography (aspect, slope and elevation). The following pages contain a brief explanation of each.

Figure 2. Percent Slope



Slopes are shown here as percent (rise/run x100). Steeper slopes intensify fire behavior and thus will contribute to a higher wildfire hazard rating. Rates of spread for a slope of 30% are typically double those of flat terrain, when all other influences are equal.

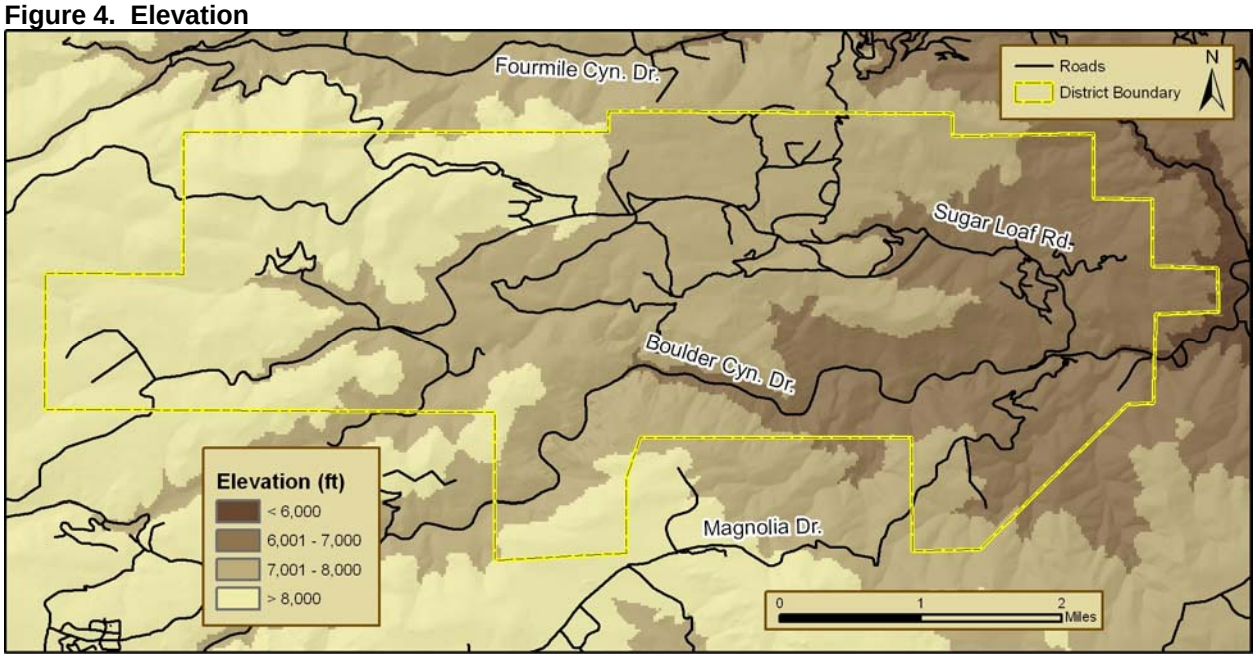
Figure 3. Aspect



Aspects are shown as degrees from north ranging from 0 to 360 according to their orientation. Aspects are influential in the type and quantity of vegetative fuels. Fuels on south facing slopes tend to be drier and more lightly loaded than fuels on north facing slopes, when all other influences are equal. Aspect also has an influence on plant species dominance.

Classification	North	East	South	West
Range	315-45	45-135	135-225	225-315

Figure 4. Elevation



Elevations within the study area range from approximately 7,500′ to over 9,500′. As elevation increases, environmental conditions, fuel species, and characteristics change.

FUEL MODELS AND FIRE BEHAVIOR

Fire behavior fuel models are a set of numbers that describe fuels in terms that a fire behavior model, in this case FlamMap, can use. There are seven characteristics used to categorize fuel models.

- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content

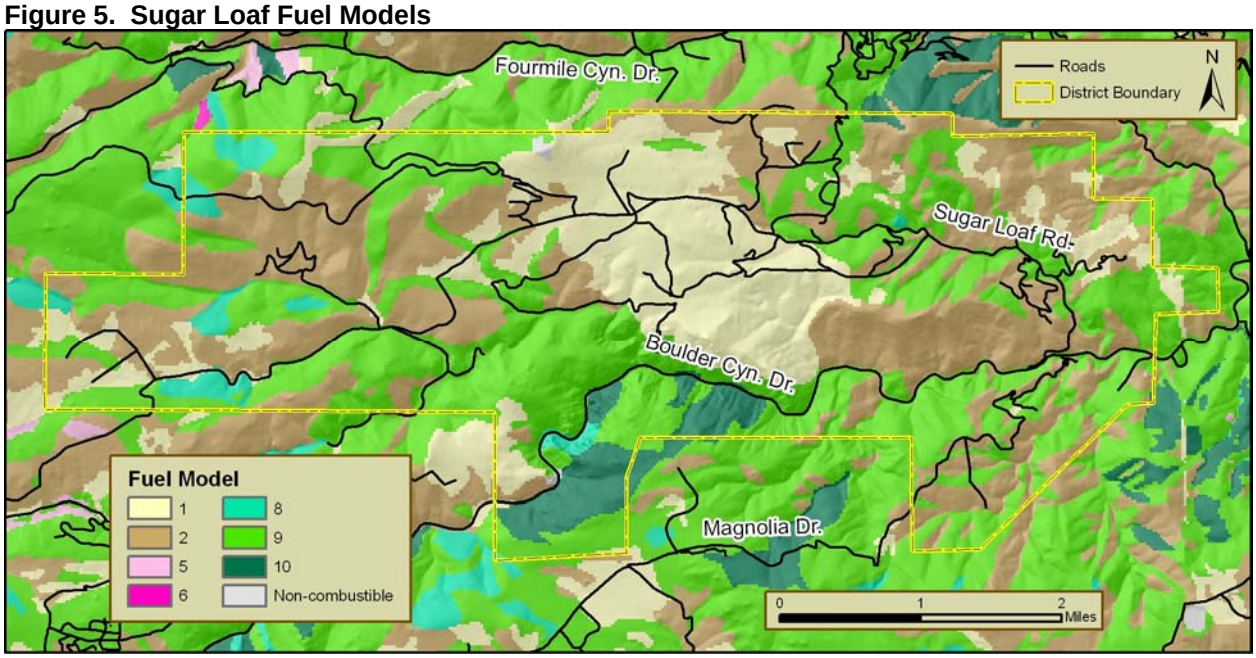
Each of the major fuel types present in the study area are described below in terms of the characteristics that coincide with that fuel model. Unless otherwise noted, fuel model descriptions are taken from Anderson's *Aids to Determining Fuel Models for Estimating Fire Behavior*[3], a national standard guide to fuel modeling.

Vegetation for the project area may or may not be specifically listed in the description. Plant species are only an aid to help visualize the characteristics of the model. The photos are taken from the project area and show where the local vegetation fits in. A table showing a range of surface fire behavior under moderate burning conditions based on the **BEHAVE** system is also included.

The study area is represented primarily by six fuel models (FM): FM 1, 2, 8, 9, 10. Other fuel models exist, but not in quantities sufficient to significantly influence fire behavior in the Wildland Urban Interface. "Non-combustible" in the map legend indicates areas of insignificant combustibility such as water, rock, sand, etc.

[3] Anderson, Hal E., *Aids to Determining Fuel Models for Estimating Fire Behavior*, National Wildfire Coordinating Group, NFES 1574, April 1982.

Figure 5. Sugar Loaf Fuel Models



FUEL MODEL 1

Figure 5. Short Grass

Characteristics

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations.

Common Types/Species

Annual and perennial grasses are included in this fuel model.

Fire Behavior

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires in this fuel model are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present—generally less than one third of the area.

FUEL MODEL 1

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	28.8	92.9	203.6	362.4	570.1	665.6
4.0	22	71.1	155.7	277	345.1	345.1
6.0	19.4	62.4	136.8	243.4	270.1	270.1
8.0	16.7	53.9	118.1	198.7	198.7	198.7
10.0	11	35.6	64.8	64.8	64.8	64.8
12.0	0	0	0	0	0	0

****Moderate Weather inputs from RAWS were used for all tables****

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3	5.1	7.3	9.6	11.8	12.7
4.0	2.4	4.1	5.9	7.8	8.6	8.6
6.0	2.2	3.8	5.5	7.1	7.5	7.5
8.0	2	3.4	4.9	6.3	6.3	6.3
10.0	1.4	2.4	3.2	3.2	3.2	3.2
12.0	0	0	0	0	0	0

FUEL MODEL 2[4]

FIGURE 8. Open canopy trees with grass understory

Characteristics

Fire spread is primarily through the fine herbaceous fuels, either curing or dead.

Common Types/Species

Open shrub lands and pine stands or scrub oak stands that cover one third to two thirds of the area may generally fit this model. Such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Some Piñon-juniper may be in this model.

Fire Behavior

These are surface fires where the herbaceous material—in addition to litter and dead/down stemwood from the open shrub or timber overstory—contributes to the fire intensity.

[4] Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 2

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

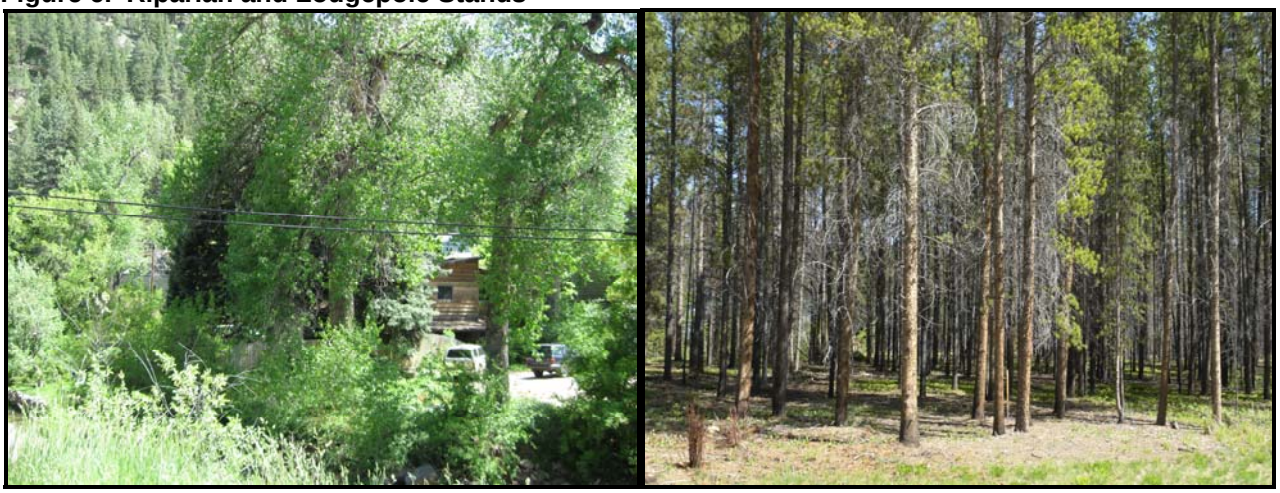
Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	14.8	40.9	80.7	133.5	198.5	275.3
4.0	12.1	33.5	66.1	109.4	162.6	225.5
6.0	10.8	29.7	58.7	97.1	144.4	200.3
8.0	9.9	27.3	54	89.3	132.8	184.2
10.0	8.9	24.4	48.2	79.7	118.5	164.4
12.0	7	19.3	38.2	63.1	93.9	130.2

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.7	7.5	10.2	12.9	15.5	18
4.0	4	6.4	8.7	11	13.2	15.4
6.0	3.7	5.9	8	10.1	12.2	14.1
8.0	3.5	5.6	7.6	9.6	11.5	13.4
10.0	3.2	5.1	7	8.9	10.6	12.4
12.0	2.7	4.2	5.8	7.3	8.8	10.2

FUEL MODEL 8

Figure 6. Riparian and Lodgepole Stands



Characteristics

Hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs, because little undergrowth is present in the stand. Amounts of needle and woody litter are also low.

Common Types/Species

Closed canopy stands of short-needle conifers or hardwoods. Representative conifer types are white pine, lodgepole pine, spruce, fir and larch.

Fire Behavior

Fires in this fuel model are slow burning and low intensity, burning in surface fuels. Fuels are mainly needles and woody litter. Heavier fuel loadings from old dead and down trees or branches can cause flare-ups. Heavier fuel loads have the potential to develop crown fires in extreme burning conditions.

FUEL MODEL 8

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	1.1	2.3	3.8	5.6	7.7	9.7
4.0	0.9	1.8	3.1	4.6	6.2	6.6
6.0	0.7	1.5	2.6	3.8	4.8	4.8
8.0	0.6	1.3	2.3	3.3	3.7	3.7
10.0	0.6	1.2	2	3	3.1	3.1
12.0	0.5	1.1	1.8	2.7	2.7	2.7

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	0.9	1.3	1.6	2	2.3	2.5
4.0	0.8	1.1	1.4	1.7	1.9	2
6.0	0.7	1	1.2	1.5	1.6	1.6
8.0	0.6	0.9	1.1	1.3	1.4	1.4
10.0	0.6	0.8	1	1.2	1.3	1.3
12.0	0.9	1.3	1.6	2	2.3	2.5

FUEL MODEL 9[4]

FIGURE 12. Timber Litter (note heavier surface fuels)

Characteristics

Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Concentrations of dead/down woody material will contribute to possible torching out of trees, spotting, and crowning.

Common Types/Species

Closed stands of long-needled pine like Ponderosa, Jeffrey, and Red pines, or southern pine plantations are grouped in this fuel model.

Fire Behavior

Fires in this fuel model run through the surface litter faster than in **Fuel Model 8** and have longer flame height. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves.

[4] Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 9

Rate of spread in chains/hour (1 chain=66 ft)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4	9.7	18	28.7	41.4	56.1
4.0	3.1	7.7	14.2	22.6	32.7	44.3
6.0	2.6	6.4	11.8	18.7	27	36.6
8.0	2.3	5.5	10.2	16.2	23.5	31.8
10.0	2	5	9.2	14.7	21.2	28.7
12.0	1.9	4.6	8.5	13.5	19.5	26.5

10 hr fuel=9, 100 hr fuel=11%, herbaceous fuel moisture=68%, slope=10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	2.3	3.5	4.7	5.8	6.8	7.8
4.0	1.9	2.9	3.9	4.8	5.7	6.5
6.0	1.7	2.5	3.4	4.2	4.9	5.7
8.0	1.5	2.3	3.1	3.8	4.5	5.2
10.0	1.4	2.2	2.9	3.5	4.2	4.8
12.0	1.4	2.1	2.7	3.4	4	4.6

FUEL MODEL 10

Figure 7. Mixed Conifer Stands

Characteristics

This model is represented by dense stands of over-mature ponderosa pine, lodgepole pine, mixed-conifer, and continuous stands of Douglas-fir. In all stand types, heavy down material is present. There is also a large amount of dead/down woody fuels. Reproduction may be present, acting as ladder fuels. This model includes stands of budworm-killed Douglas-fir, closed stands of Ponderosa pine with large amounts of ladder and surface fuels, and stands of Lodgepole pine with heavy loadings of downed trees. This model can occur from the foothills through the sub-alpine zone.

Common Types/Species

Many types of vegetation can occur in this model, but primary species are Spruce/fir, Ponderosa pine, and Lodgepole pine.

Fire Behavior

Fire intensities can be moderate to extreme. Fire moves through dead, down woody material. Torching and spotting are more frequent. Crown fires are quite possible.

FUEL MODEL 10

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3.8	8.3	14	20.5	27.7	35.6
4.0	3.4	7.4	12.4	18.1	24.6	31.6
6.0	3.1	6.7	11.2	16.5	22.3	28.7
8.0	2.9	6.2	10.4	15.3	20.7	26.6
10.0	2.7	5.9	9.9	14.4	19.6	25.1
12.0	2.6	5.6	9.4	13.8	18.6	24

10-hr fuel = 9%, 100 = 12%, woody fuel moisture = 102%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3.9	5.5	7	8.3	9.6	10.7
4.0	3.5	5	6.3	7.5	8.6	9.7
6.0	3.2	4.6	5.8	7	8	9
8.0	3	4.3	5.5	6.6	7.6	8.5
10.0	2.9	4.2	5.3	6.3	7.2	8.1
12.0	2.8	4	5.1	6.1	7	7.9

Reference Weather Used in the Fire Behavior Potential Evaluation

The weather inputs for FlamMap were created by using weather data collected at the Sugar Loaf Remote Automated Weather Station (RAWS).

Sugar Loaf Site Information

Latitude (dd mm ss)	**40 ° 01 ' 05 " N**
Longitude (dd mm ss)	**105 ° 21 ' 39 " W**
Elevation (ft.)	6,758

Weather observations for a 30 year period (1977-2007) were used to calculate these conditions. The moderate conditions class (16th to 89th percentile) was calculated for each variable (1 hour, 10 hour, and 100 hour fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed) using Fire Family Plus. This weather condition class most closely represents an average fire season day.

The extreme conditions class was calculated using 97th percentile weather data. This means that the weather conditions on the most severe fire weather days (sorted by Spread Component) in each season for the twenty-year period were used for this analysis. It is reasonable to assume that similar conditions may exist on at least three to five days of the fire season during an average year. In fact, during extreme years such conditions may exist for significantly longer periods. Even these calculations may be conservative compared to observed fire behavior. The following values were used in **FlamMap**:

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	11 mph
Herbaceous fuel moisture	49%
Woody fuel moisture	95%
100-hr fuel moisture	11%
10-hr fuel moisture	9%
1-hr fuel moisture	6%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	26 mph
Herbaceous fuel moisture	30%
Woody fuel moisture	77%
100-hr fuel moisture	10%
10-hr fuel moisture	8%
1-hr fuel moisture	5%

(Note: Strong winds at 20 ft will feel significantly less noticeable on the skin at ground level. For example, a "gentle breeze" on the skin may constitute an 11 MPH 20-foot wind, adding one of the components necessary for extreme weather conditions.)

FIRE BEHAVIOR ANALYSIS OUTPUTS

Fire Behavior Modeling Limitations and Interpretation

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point-source ignition in every cell (each 10 x 10 meter area). It does not consider cumulative impacts of increased fire intensity over time and space. Nor does this model calculate the probability that a wildfire will occur. It assumes an ignition occurrence for every cell. These calculations may be conservative (under-predict) compared to observed fire behavior.

This model can be conceptually overlaid with the Community Wildfire Hazard Ratings (WHR) or other identified Values at Risk to generate current and future "areas of concern," which are useful for prioritizing mitigation actions. This is sometimes referred to as a "values layer." One possibility is to overlay the fire behavior potential maps with the community hazard map in order to make general evaluations of the effects of the predicted fire behavior in areas of high hazard value (areas where there are concentrations of residences and other infrastructure. However, it is important to keep in mind that the minimum mapping unit used for fire behavior modeling is 1 acre. Therefore, fine-scale fire behavior and effects are not considered in the model. Moreover, weather conditions are extremely variable and not all combinations are accounted for.

The fire behavior prediction maps are best used for pre-planning and not as a stand-alone product for tactical planning. If this information is used for tactical planning, fire behavior calculations should be made with actual weather observations during the fire event. For greatest accuracy, the most current Energy Release Component (ERC) values should be calculated and distributed during the fire season to be used as a guideline for fire behavior potential. See **Appendix B** for further discussion of the WHR methodology.

Crown Fire Activity

The Crown Fire Activity maps (**Figures 12 and 13**) display the potential for fires to move from the surface into the canopy of trees and shrubs. The likelihood of progression from the surface into the aerial fuels is displayed in **four categories**.

1. **Non-combustible** refers to areas where surface fires are unlikely to develop, due to the lack of combustible fuels. These would include any area lacking a combustible fuel bed such as rock, ice, snow fields, water, sand or some urban landscapes.
2. The **surface fire category** covers areas where fires are expected to be limited to the surface fuels and lack the energy to initiate and sustain vertical development into the aerial fuels. Areas where grass fuels without overstory plants are dominant fall into this category, regardless of the energy produced by the fire, due to the lack of an aerial fuel bed.
3. Areas covered by the **torching category** are expected to experience isolated combustion of the tree crowns in individual trees and groups of trees. In other words, individual or relatively small clusters of trees will be completely involved, but these fires lack the energy to initiate sustained horizontal movements (referred to as "runs" by fire fighters) through the crowns.
4. The **active crown fire** category includes areas where sustained horizontal movement through tree crowns is expected. This category can be further subdivided into "dependent" or "independent" crown fire.

- **Dependent crown fires** rely on the presence of surface fires to support aerial burning. Independent crown fires develop when aerial burning is sustained without the need for associated surface fire.
- **Independent crown fires** are rare and are associated with the most extreme fire behavior conditions. Current fire behavior models do not have the ability to predict independent crown fire development.

All crown fires, regardless of whether they are dependent or independent, represent extreme fire behavior conditions and are notoriously resistant to all methods of suppression and control. Crown fire activity, rate of spread, and flame length are derived from the fire behavior predictions. The following maps graphically display the outputs of **FlamMap** for both average and extreme weather conditions.

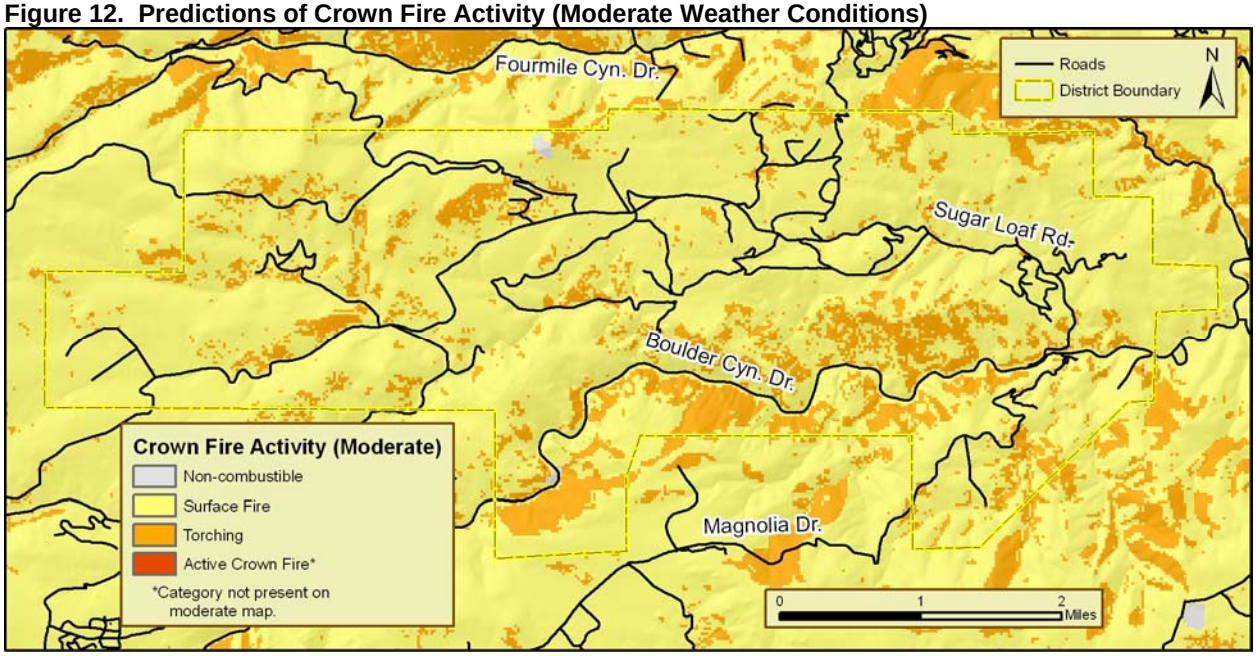
Rate of Spread

Figures 14 and **15** show the predicted rates of spread for the moderate fire weather and extreme fire weather scenarios, respectively. Rates of spread are expressed in chains/hour (CPH). A chain is a unit of measure commonly used by loggers and firefighters. It is equal to 66 feet; therefore one mile equals 80 chains. Rates of fire spread are influenced primarily by the wind, slope steepness, fuel type/continuity and fuel sheltering from the wind. Fire is the only force of nature which moves faster uphill than downhill. When all other factors are equal, fire moves twice as fast uphill on a slope of 30% than it does on flat terrain. In areas where high to extreme rates of spread are predicted (ROS of >40 CPH or ½ mile per hour) it is possible that fires would spread faster than humans could escape, creating extremely dangerous conditions for firefighters and evacuating residents. High rates of spread also make suppression efforts less effective and increase the tactical complexity of the incident.

Flame Length

Figures 16 and 17 display the flame length predictions for the two weather scenarios. Flame length is a proxy for fire intensity. It is important to note that flame length is considered the entire distance from the base of the flame to the tip, irrespective of angle—not simply the flame height above the ground. It is possible in high wind conditions to have very intense flames (high flame lengths) which are relatively close to the fuel bed. The legend boxes display flame length in ranges which are meaningful to firefighters. Flame lengths of four feet and less are deemed low enough intensity to be suitable for direct attack by hand crews and therefore represent the best chances of direct extinguishment and control. Flame lengths of less than eight feet are suitable for direct attack by equipment such as bulldozers and tractor plows. Flame lengths of eight to 12 feet are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 12 feet, the most effective tactics are fuel consumption ahead of the fire by burnouts or mechanical methods. Although indirect fire line and aerial attack are also used for fires with flame lengths of greater than 12 feet, as flame lengths increase, the effectiveness of these tactics decreases. In such cases, these tactics are generally intended to slow rates of spread and reduce fire intensity, especially in areas where Values at Risk are concentrated.

Figure 12. Predictions of Crown Fire Activity (Moderate Weather Conditions)



Crown fire activity values are generated by the **FlamMap** model and classified into four categories based on standard ranges: Active, Torching, Surface, and Not Applicable. In the surface fire category, little or no tree torching will be expected. During passive crown fire activity, isolated torching of trees or groups of trees will be observed and canopy runs will be limited to short distances. During active crown fire activity, sustained runs through the canopy will be observed that may be independent of surface fire activity.

Figure 13. Predictions of Crown Fire Activity (Extreme Weather Conditions)

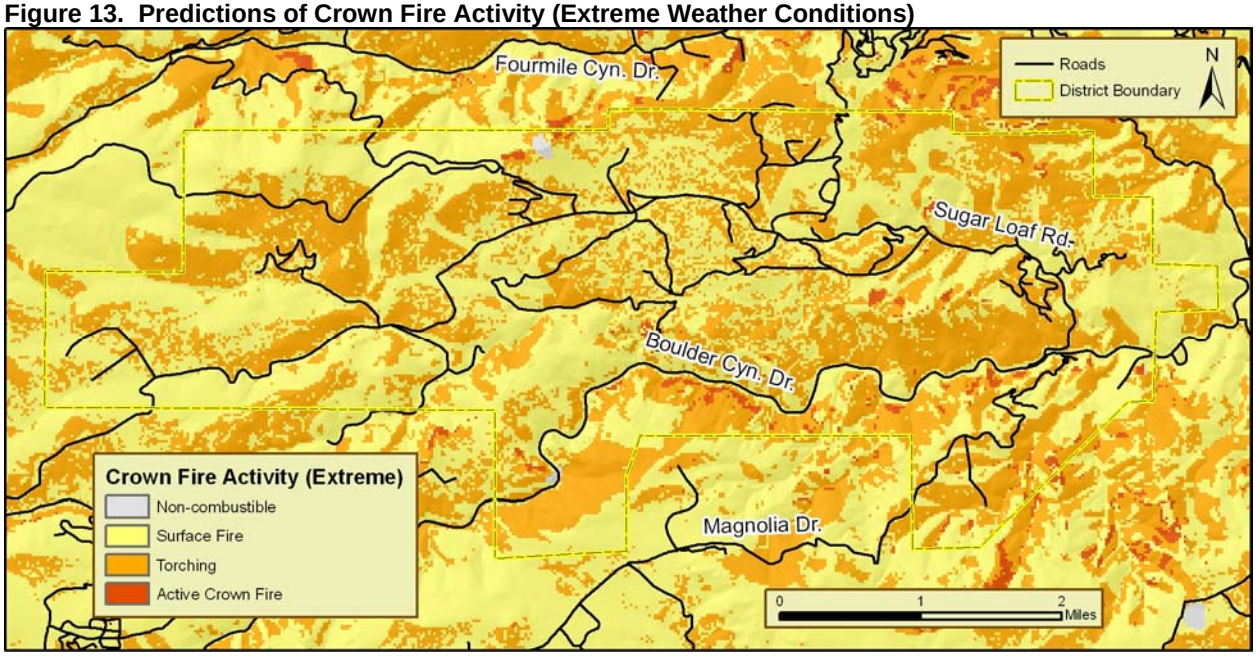
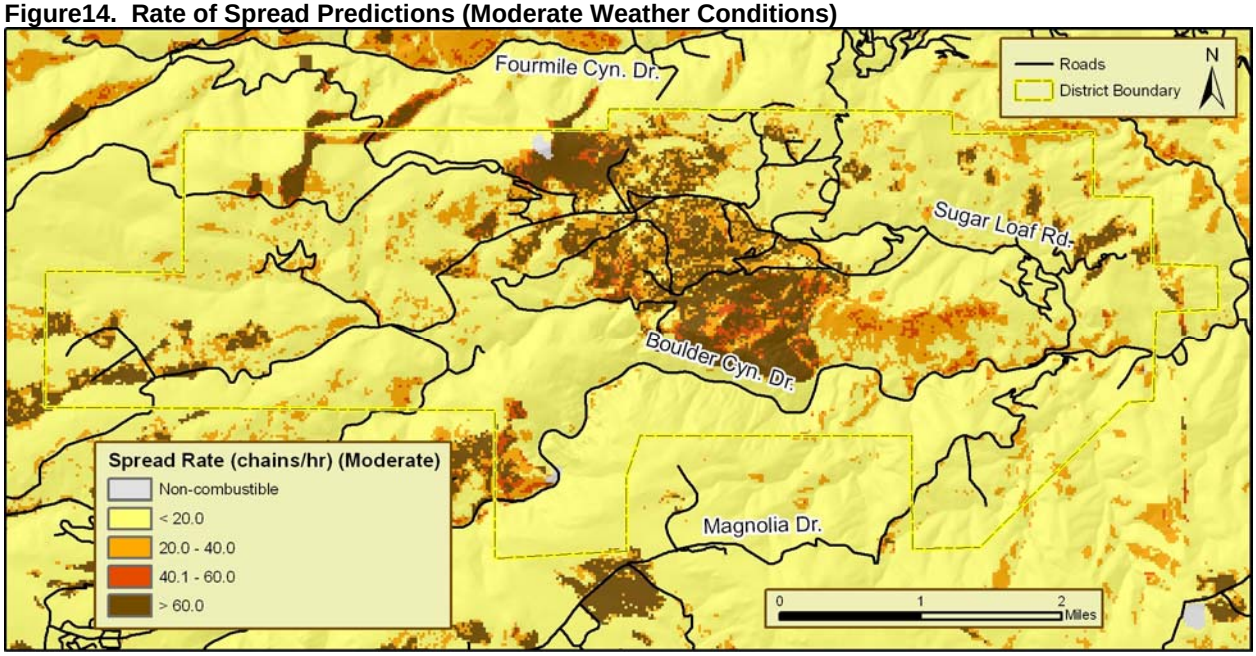


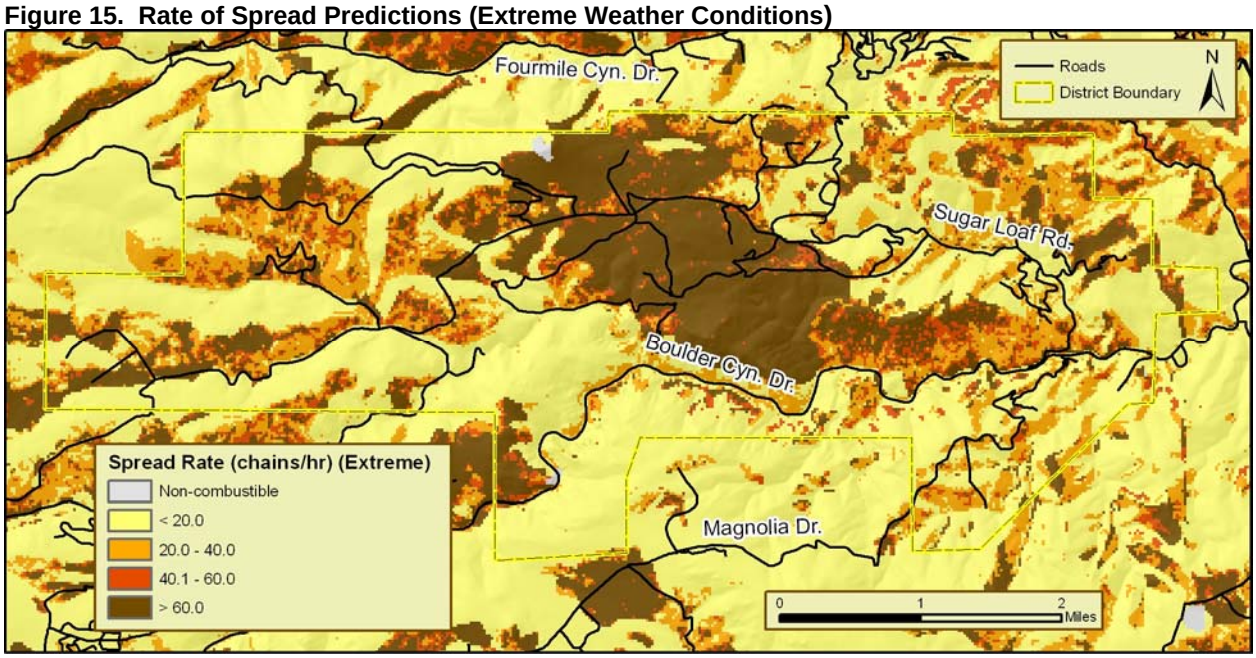
Figure14. Rate of Spread Predictions (Moderate Weather Conditions)



Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

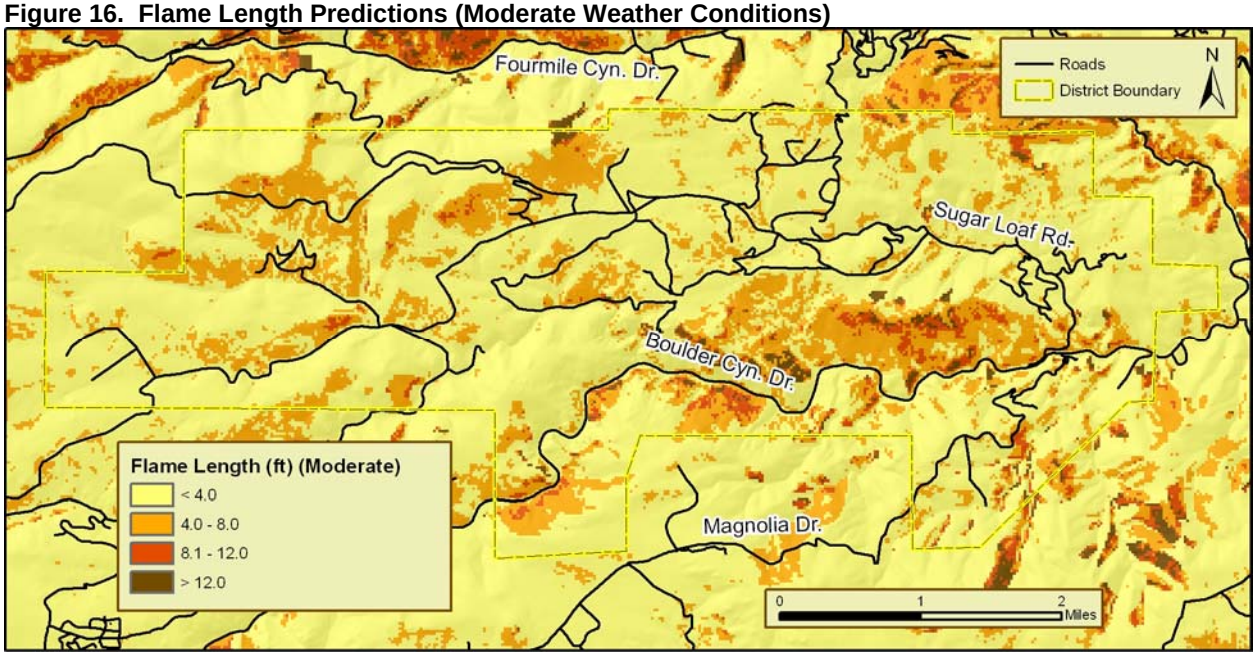
Spread rate values are generated by the **FlamMap** model and classified into four categories based on standard ranges: 0-20 ch/h (chains/hour), 20.1-40 ch/h, 40.1-60 ch/h, and greater than 60 ch/h. A chain is a logging measurement equal to 66 feet. 1 mile equals 80 chains. 1 chain per hour equals approximately 1 foot/minute; 80 chains per hour equals 1 mile per hour.

Figure 15. Rate of Spread Predictions (Extreme Weather Conditions)



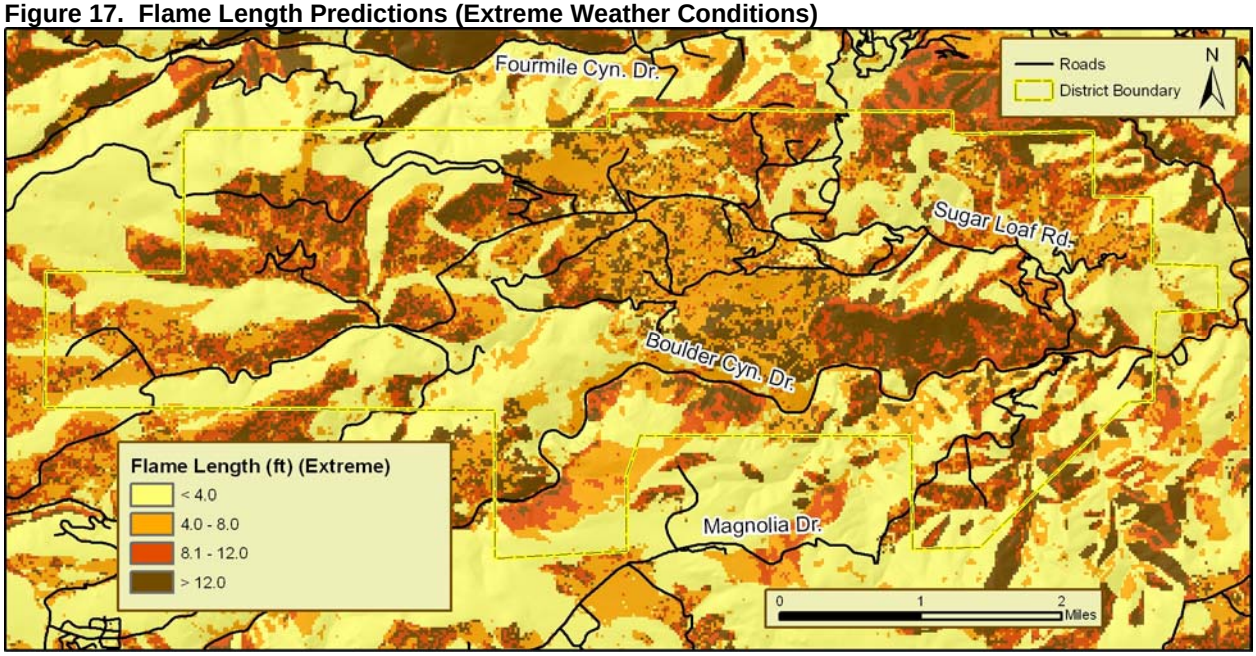
Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Figure 16. Flame Length Predictions (Moderate Weather Conditions)

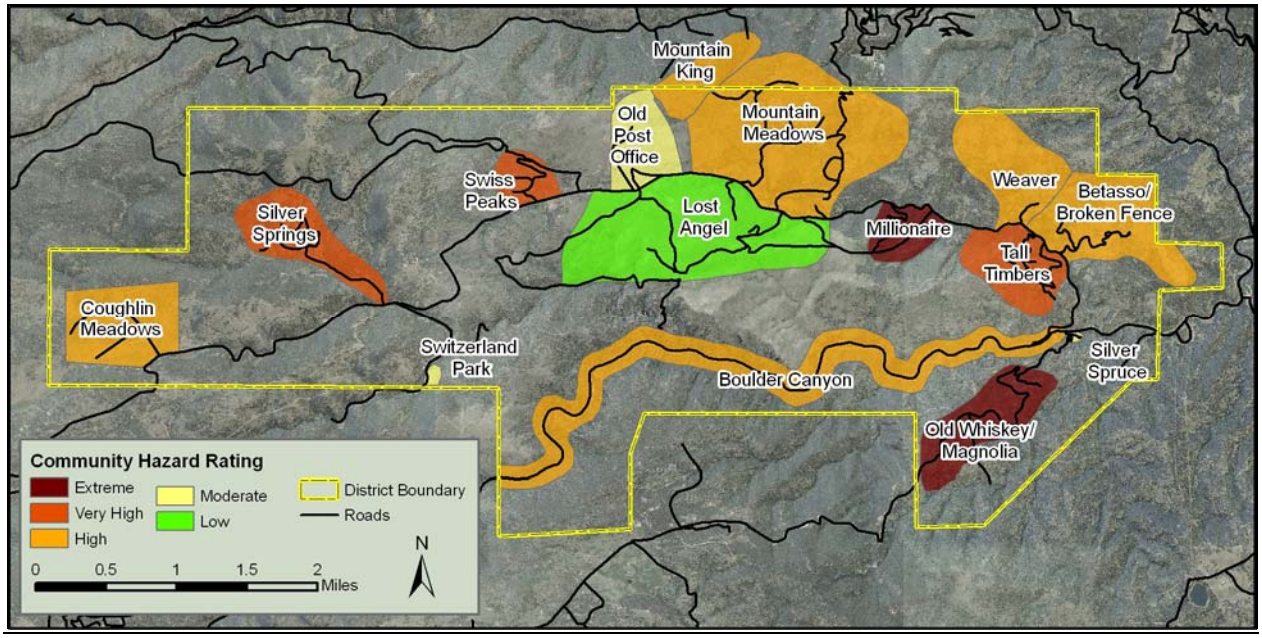


Flame length values are generated by the **FlamMap** model and classified in the four categories based on standard ranges: 0-4 feet, 4.1-8 feet, 8.1-12 feet and 12.1-60 feet. Flame lengths of 4 feet or less are acceptable for direct attack by hand crews. Flame lengths of 8 feet or less are suitable for direct attack by machinery. For flame lengths greater than 8 feet, indirect attack and aerial attack are the preferred methods.

Figure 17. Flame Length Predictions (Extreme Weather Conditions)



APPENDIX B: COMMUNITY IGNITIBILITY ANALYSIS AND RECOMMENDATIONS



PURPOSE

The purpose of this appendix is to examine in greater detail the communities in the study area. Of the 15 WUI communities in The Sugar Loaf Fire Protection District (SLFPD), two were found to represent an extreme hazard, three were very high hazard; six were rated as high hazard; three as moderate hazard; one as low hazard (see Figure1). While adhering to a proven rating methodology, Anchor Point strives to approach each community as a unique entity with its own unique characteristics, so that we can provide the most accurate, safe, and useful assessments possible. For easy reference, the map of communities presented in the main text has been reproduced here as Figure 2. Figure 3 displays this grouping graphically.

Figure 1.

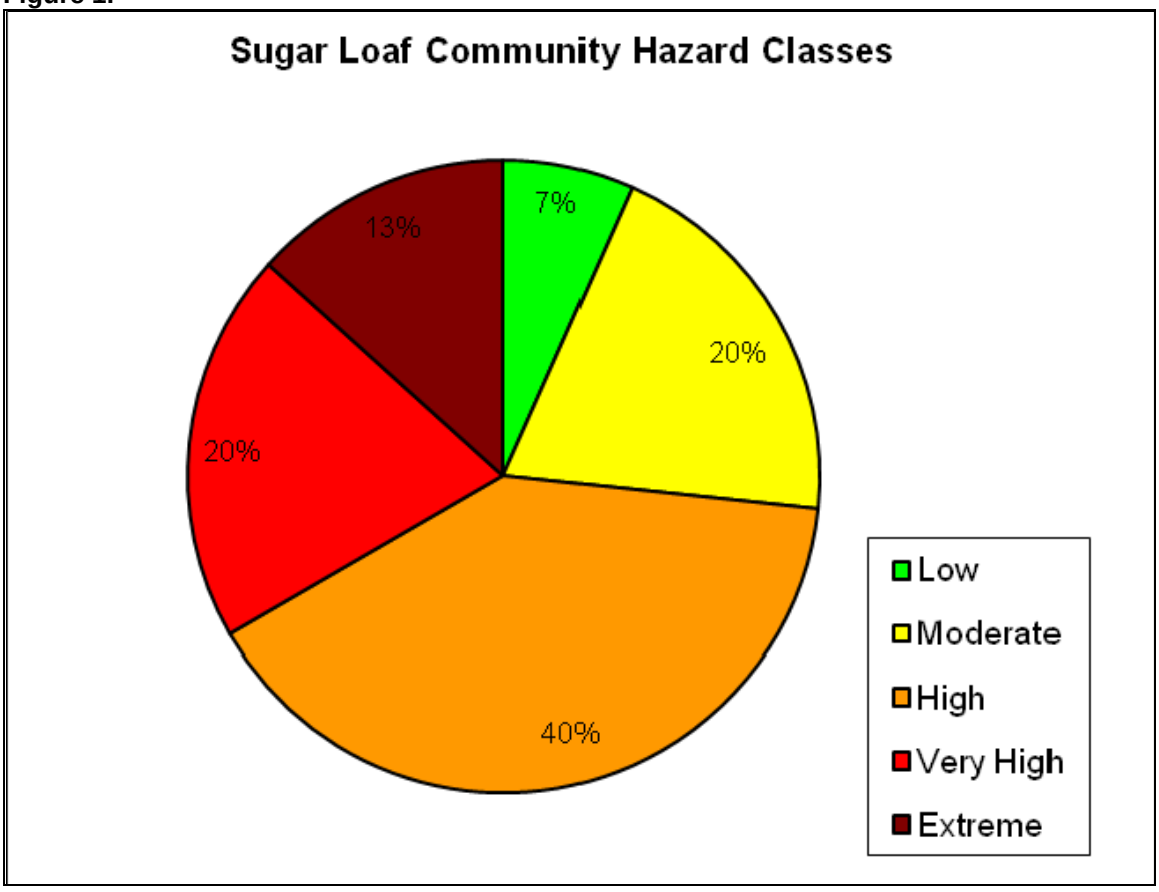


Figure 2.

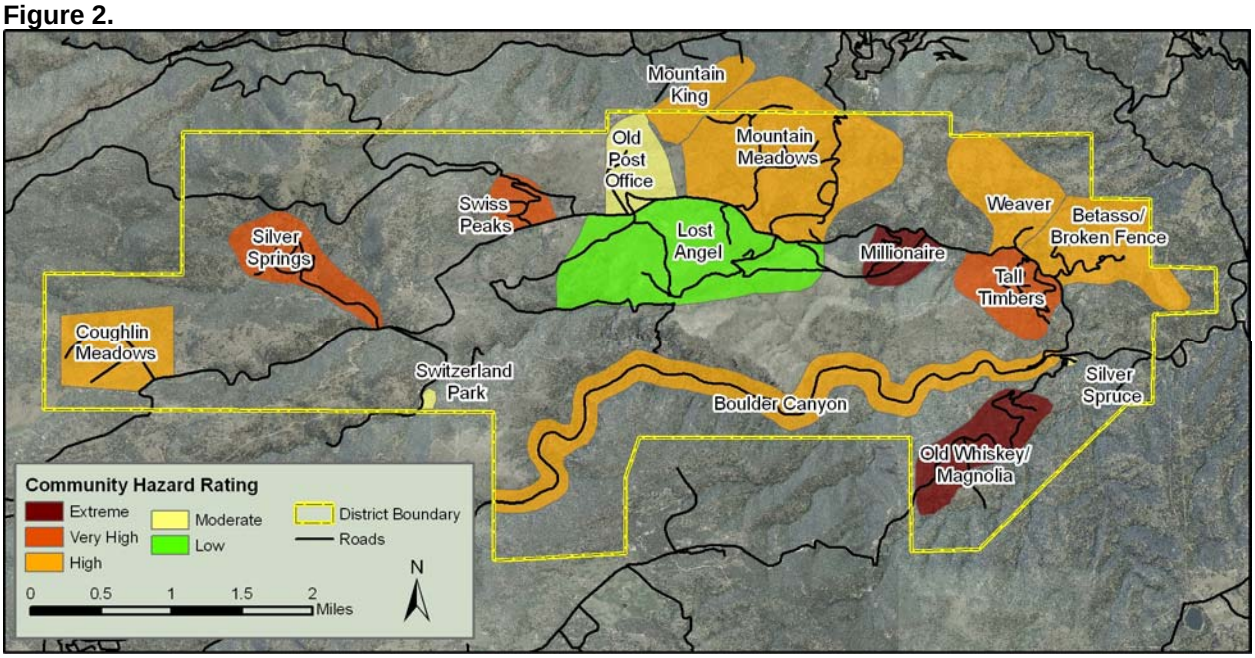
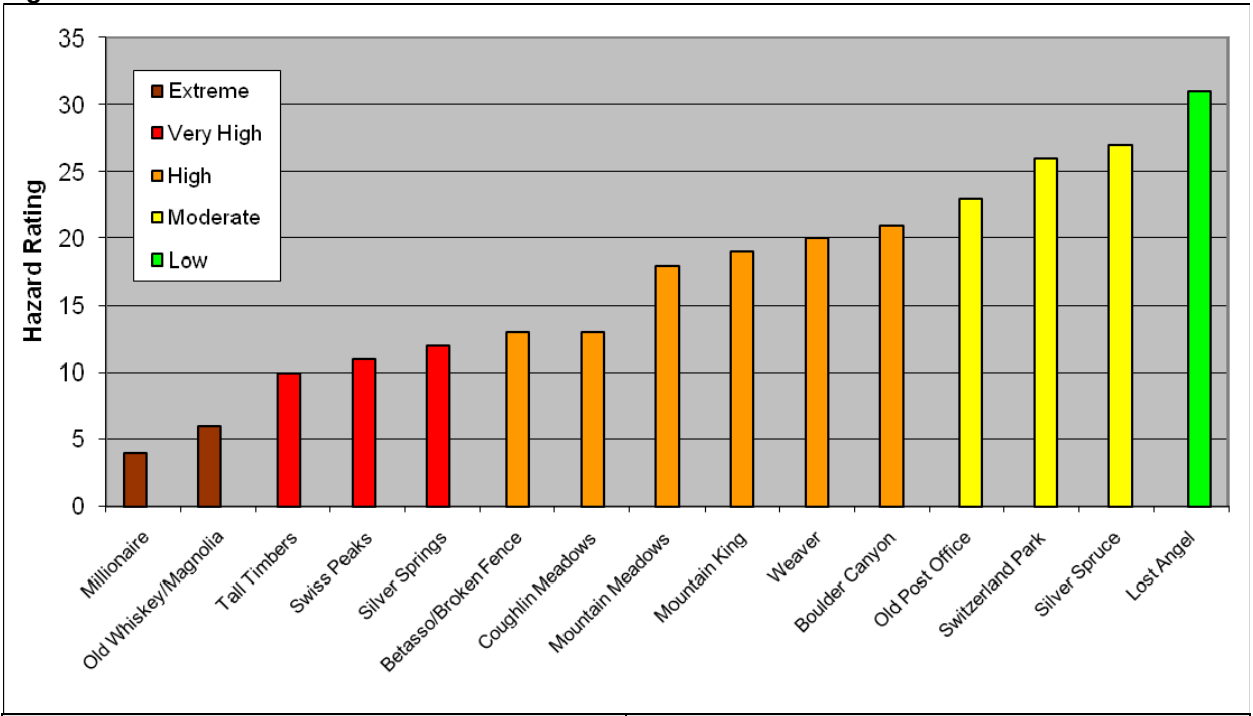

Mountain King
Old Post Office
Mountain Meadows
Swiss Peaks
Silver Springs
Lost Angel
Weaver
Betasso/ Broken Fence
Millionaire
Tall Timbers
Coughlin Meadows
Switzerland Park
Boulder Canyon
Silver Spruce
Old Whiskey/ Magnolia
Community Hazard Rating
Extreme
Very High
High
Moderate
Low
District Boundary
Roads
N
0 0.5 1 1.5 2 Miles

Figure 3.



1. Millionaire	9. Mountain King
2. Old Whiskey/Magnolia	10. Weaver
3. Tall Timbers	11. Boulder Canyon
4. Swiss Peaks	12. Old Post Office
5. Silver Springs	13. Switzerland Park
6. Betasso/Broken Fence	14. Silver Spruce
7. Coughlin Meadows	15. Lost Angel
8. Mountain Meadows	

GENERAL RECOMMENDATIONS

A combination of adequate access, ignition-resistant construction, and fuels management will help create a safe environment for emergency service personnel and will provide reasonable protection to structures in the event of a wildfire. These techniques should also significantly reduce the chances that a structure fire will become an ignition source to the surrounding wildlands.

In addition to the suggested mitigations listed for the individual communities, several general measures can be taken to improve fire safety. The following recommendations should be noted and practiced by anyone living in the Wildland-Urban Interface:

1. Stay aware of the current fire danger in the area.

2. Clean roof and gutters at least twice a year, especially during cure-up in autumn.

3. Stack firewood uphill or on a side contour, at least 30 feet away from structures.

4. Don't store combustibles or firewood under decks.

5. Maintain and clean spark arresters on chimneys.

6. When possible, maintain an irrigated greenbelt around the home.

7. Connect, and have available, a minimum of 50 feet of garden hose.

8. Post reflective lot and/or house numbers so that they are clearly visible from the main road. Reflective numbers should also be visible on the structure itself.

9. Trees along driveways should be limbed and thinned as necessary to maintain a minimum 13′6″ vertical clearance for emergency vehicle access.

10. Maintain your defensible space constantly:
    - Mow grass and weeds to a low height
    - Remove any branches overhanging the roof or chimney
    - Remove all trash, debris, and cuttings from the defensible space

Note: All communities rated as Extreme, Very High, or High Hazard were recommended for a parcel-level analysis. In the Moderate Hazard communities, a parcel-level analysis was recommended only if the evaluator found that a significant number of homes had no defensible space (or ineffective defensible space), or if a significant number of hazards near homes was detected. In short, the recommendation was made if the evaluator felt that information gathered by a parcel-level analysis could be used to generate a noticeable improvement in the community's defensibility.

TECHNICAL TERMS

The following definitions apply to terms used in the “Description” and “Recommendations” sections of this appendix.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or away from the structure. The design and extent of the defensible space is based on fuels, topography, and the design and materials of the structure. Zone 1 is defined as the area 15 to 30 feet (depending on the reference source) from the structure. In Zone 1, flammable vegetation is generally removed entirely. The Zone 2 treatment area varies with slope and focuses on fuels modifications such as limbing and thinning.

Extended Defensible Space (also known as Zone 3): In this defensible space zone treatment is continued beyond the recommended minimum boundary for Zone 1 and Zone 2 defensible space. This zone focuses on forest management with fuels reduction being a secondary function.

Survivable Space: Survivable space is differs from defensible in that the goal of survivable space is to create an area around each home that will allow it to survive a wildfire without fire fighting resources defending each structure.

Fuelbreak: A natural or constructed discontinuity in a fuel profile used to segregate, stop, or reduce the spread of fire. As a practical matter, fuelbreaks in the WUI are most effective against crown fires.

COMMUNITY ASSESSMENT METHODOLOGY

The community level methodology for this assessment uses a Wildfire Hazard Rating (WHR) that was developed specifically to evaluate communities within the Wildland Urban Interface (WUI) for their relative wildfire hazard.[1] The WHR model combines physical infrastructure such as structure density and roads, and fire behavior components like fuels and topography, with the field experience and knowledge of wildland fire experts. It has been proven and refined by use in rating over 1,400 neighborhoods throughout the United States.

In developing this methodology, many knowledgeable and experienced fire management professionals were queried about specific environmental and infrastructure factors, as well as wildfire behavior and hazards. Weightings within the model were established through these queries. The model was designed to be applicable throughout the western United States, and was developed specifically from the perspective of performing structural triage on a threatened community in the path of an advancing wildfire with moderate fire behavior.

The WHR survey and fuel model ground truthing are accomplished by field surveyors with WUI fire experience. The rating system assigns up to a maximum of 60 points based on seven categories: average lot size, slope, primary aspect, average fuel type, fuel continuity, dominant construction type and surface fuel loading. The higher the community's score, the lower its wildfire hazard. For example, a community with an average lot size of less than 1 acre and slopes of greater than 30% would receive 0 points for those factors, whereas a community with an average lot size of 5 acres and slopes of less than 15% would receive 16 points for the same factors. Additional hazards are then subtracted from the subtotal of points earned in the seven categories to give a final numeric value. The final value is then used to group communities into one of five hazard ratings: Extreme, Very High, High, Moderate, or Low. It is important to note that the position and numbering of the communities within each of these groupings should not be used as an indicator of relative hazard. The numeric rating score is not sufficiently precise to allow hazard sorting beyond the group adjective rating, and should not be used to draw conclusions about greater or lesser hazards among communities within a group.

It is important to note that not all groupings occur in every geographic region. There are some areas with no low hazard communities, just as there are some areas with no extreme communities. The rankings are also related to what is customary for the area. For example, a high hazard area on the plains of Kansas may not look like a high hazard area in the Sierra Nevada. The system creates a relative ranking of community hazards in relation to the other communities in the study area. It is designed to be used by experienced wildland firefighters who have a familiarity with structural triage operations and fire behavior in the interface.

1 C. White, "Community Wildfire Hazard Rating Form" Wildfire Hazard Mitigation and Response Plan, Colorado State Forest Service, Ft. Collins, CO, 1986.

COMMUNITIES

1. Millionaire

Hazard Rating:	Extreme
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	2, 9
Water supply:	None
Hazards:	Ravines, steep narrow roads

Description: The Millionaire neighborhood has two access points – Millionaire East and Millionaire West. They are connected, but the existing track is only suitable for ATV or 4x4 access, so for practical purposes the homes in this community are located on two single-access, dead-end roads. Both access roads are dirt, and are steep and narrow. The access road in Millionaire East is the worse of the two. Fuels are decadent, overgrown Ponderosa pine stands. There is also a power line, which can increase the threat to fire fighters because of the possibility of arcing lines from heavy smoke. Wood siding and asphalt shingle roofs are dominant. Some properties have flammable yard clutter. The topography is steep, with ravines and multiple aspects.

MILLIONAIRE RECOMMENDATIONS

- **►► 4:** In order to help protect the community from an upslope fire run, a shaded fuel break along Sugar Loaf road, running east to west 50-100 ft up the south side of the road is recommended.
- **► E:** Consider improving the two-track between Millionaire East and Millionaire West for emergency evacuation.
- **► E:** Millionaire West connects to Lost Angel Road. This road could be improved for use as an evacuation/fire fighter access route.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing fuel loads in drainages that cross roads.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Add reflective addressing to all driveways and homes.

► See ***Access Route Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

►► See ***Proposed Landscape Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

2. Old Whiskey/Magnolia

Hazard Rating:	Extreme
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	2, 9, 10
Water supply:	Yes – cistern
Hazards:	Ravines, steep canyons

Description: Old Whiskey has two entrances off Magnolia Road, but they "Y" together, making the community single-access. There is a 10,000 gallon cistern at 900 Magnolia, across the road from one of the entrances. Addressing is poor throughout. This community is steep and heavily wooded. Roads are dirt, and are steep and narrow with few turnouts. The topography in Old Whiskey is complex, with deep ravines. Fuels include a closed canopy of overgrown ponderosa pine with heavy ladder fuels and shrubs and grasses in some of the understory. The steep terrain limits the ability to perform fuels treatments. There are many long, narrow, and steep driveways. There are some scattered homes on Magnolia, but most of the ones below Old Whiskey are on single access common driveways (one of these is one mile long). These homes are situated in a similar topography, and home construction and fuels are also similar to Old Whiskey. The Sugar Loaf Fire Protection District ends about 2 miles above Old Whiskey.

OLD WHISKEY RECOMMENDATIONS

- **► B, C:** Old Whiskey and Magnolia Roads should be improved for use as evacuation routes. Limb and trim along roads to reduce ladder fuels. Focus on removing fuel loads in drainages that cross roads.
- **►► 5, 6:** A fuels reduction project between Hawkins Gulch and Keystone Gulch is highly recommended.
- Apparatus pullouts should be used for emergency parking only. Consider enforcing parking violations if pullouts are used for parking under normal circumstances.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

► See ***Access Route Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

►► See ***Proposed Landscape Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

3. Tall Timbers

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 acres
Fuel models found in the neighborhood:	2, 9
Water supply:	Yes
Hazards:	Narrow drainages, steep roads

Description: There is dual access into Tall Timbers (East and West Kelly Road), but these are steep, narrow roads. There are many narrow and rough dirt spur roads and driveways (e.g., Canyon View). There are a few pullouts but the roads are not wide enough in most places to pass apparatus. Road markers throughout Tall Timbers are poor. There is a mix of new and older homes, but most are older construction that has been remodeled or expanded. The topography in Tall Timbers is very steep topography with heavy fuels. Many homes in this community have vegetation growing right up to the structure. There are also many homes that are dangerously positioned mid-slope and in drainages. The south facing slopes are also susceptible to ignitions from Boulder Canyon. Although there are water sources, they are not adequate for the number of homes in this community.

TALL TIMBERS RECOMMENDATIONS

- **►► 2:** Create a fuelbreak between Tall Timbers and Sugar Loaf road.
- **►► 3:** Fuels reduction should be implemented in drainages between Kelly Road East and West.
- Add an additional cistern on the lower section of Kelly Road East.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

►► See ***Proposed Landscape Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

4. Swiss Peaks

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1, 2, 9
Water supply:	Yes
Hazards:	Steep dirt roads

Description: Primary access to Swiss Peaks is off Sugar Loaf Road, but it can also be accessed from the Switzerland Trail (however, this intersection is not marked and is very steep). Most of the homes are built on the same slope on a southern exposure, between Sugar Loaf Road and Switzerland Trail. Homes are small to mid-size on mid-size lots. Home construction in this community is a mix of old and new. Address markers in Swiss Peaks are inconsistent, and there are some common driveways, making identification of homes more difficult. Roads are dirt, steep, and narrow in spots. There is a mix of open and closed canopy Ponderosa pine with grass understory. Fuel loads are generally moderate. There is a hydrant connected to a 10,000 gallon tank right on the access road.

SWISS PEAKS RECOMMENDATIONS

- Mowing and maintaining low ground fuels is critical in this area due to the high grass component.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

5. Silver Springs

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1**,** 2, 9, 10
Water supply:	Yes
Hazards:	Long response time

Description: The Silver Springs community is located in a dead-end canyon. The only access to the 20-25 homes in this community is via Primos Road. There is a wet meadow and stream in the southern end of this community (along Primos Road), but most of the homes are located further up the canyon. There are also riparian shrubs in the drainage that stay wet most of the year.. Most homes are located mid-slope on moderate to steep slopes, and there are several chimneys. Fuel canopy is broken and sparse. Address markers are inconsistent, and although some are reflective, the street signs are wooden (non- reflective) on wooden poles. Some long narrow driveways with switchbacks exist in this community. Since most of Sugar Loaf's firefighters live in the east end of the district, response times to this area could be long.

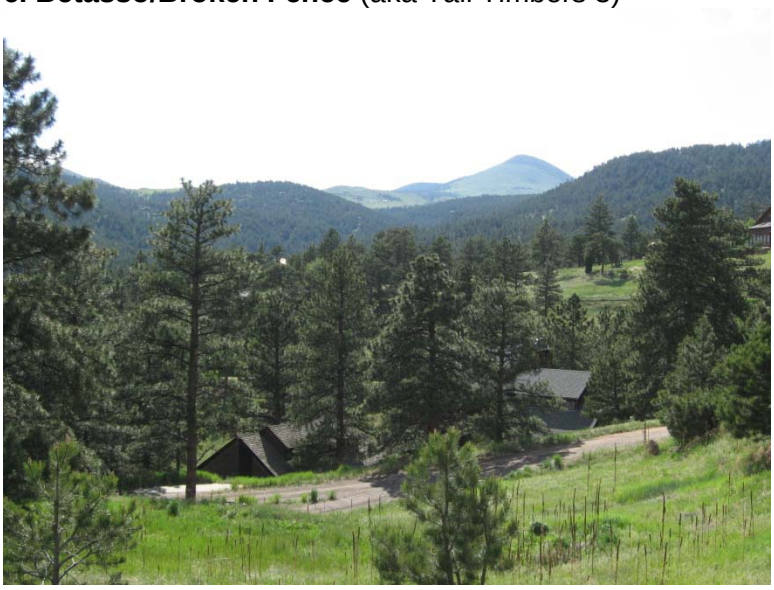
***** Please note that the homes on the first left off Primos road were not considered for the community rating. They would rate as Extreme, due to heavy fuels and very steep roads.

SILVER SPRINGS RECOMMENDATIONS

- **►► 8, 9:** Roadside treatments should be conducted along the hairpins on Primos and Nightshade.
- Improve turnaround at Silver Springs Pond #1.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

►► See ***Proposed Landscape Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

6. Betasso/Broken Fence (aka Tall Timbers 3)



Hazard Rating:	**High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 acres
Fuel models found in the neighborhood:	1, 2, 9
Water supply:	Yes
Hazards:	Power lines, steep topography

Description: This community has heavy to moderate fuel loads throughout. Topography is steep topography, though not as steep as Millionaire or Tall Timbers. Home construction is a mix of old and newer types. Wood siding and asphalt roof is dominant, but there are some wood shake roofs. Most homes are close to access roads, but there are some long, narrow dirt driveways as well as some unmarked common driveways. The only water is at the treatment plant. There is one good turnaround for apparatus at the end of Broken Fence. Several fuel treatments have been done and/or are planned around the Betasso treatment plant and the slope from Boulder Canyon to Betasso. This area experiences a high level of recreational use. BBQ grills are frequently in use on Boulder County Open Space lands.

BETASSO/BROKEN FENCE RECOMMENDATIONS

- **►► 1:** A marked fuels reduction project on the Canyon Link trail should be completed.
- **►► 1:** Remove slash that has been piled in drainages on Canyon Link trail.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

►► See *Proposed Landscape Fuels Modifications Recommendations* in the main report for a more detailed description of this project.

7. Coughlin Meadows

Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1, 2, 9
Water supply:	Yes
Hazards:	Shake roofs, power lines

Description: Access to the approximately 20 homes in this community is one way in and out. There are two spur roads (both dead ends) off Coughlin Meadows. Sugar Court is also a dead end, and while not physically connected to Coughlin Meadows it is similar in character from an interface perspective and has therefore been included in this community. Like Silver Springs there is a riparian area with a meadow that stays wet most of the summer. Most of the homes are located in the timber and most have conifer fuels too close to the structure. There are heavy to moderate loads of closed canopy conifer broken by meadows and the riparian area. Conifer fuels here are still primarily Ponderosa pine with a grass understory but there is also some Lodgepole pine. Address markers throughout this community are poor, and in most cases they are not visible from the road. Of some concern is the potential for increased ignitions due to camping on adjacent USFS lands. Most of Sugar Loaf's firefighters live in the east end of the district, so response times to this area could be long. There is an active HOA in Coughlin Meadows.

COUGHLIN MEADOWS RECOMMENDATIONS

- Mowing and maintaining low ground fuels is critical in this area due to the high grass component.
- Coordinate with USFS for patrol of camping areas and illegal fires.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

8. Mountain Meadows

Hazard Rating:	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 acres
Fuel models found in the neighborhood:	1, 2, 9
Water supply:	Yes
Hazards:	Flashy fuels, ravines

Description: Mountain Meadows is located on the southwest face of Arkansas Mountain, which has a history of heavy lightning activity. This is one of the highest density communities in Sugar Loaf, with a large number of homes, mostly on 1-3 acre lots. Asphalt roof and wood siding construction are dominant, but some homes have wood shake roofs. Approximately 60% of the homes have been mitigated or are implementing a mitigation plan. Plainsview Road has had a large amount of mitigation work done. USFS has also mitigated their land in this community. The canopy is not continuous – it is broken by meadows and mitigation work – but there are still some pockets of over-mature, closed-canopy conifer. Mowing and grazing has kept most of the grasses short. A high percentage of the homes in Mountain Meadows are horse properties. Access roads are generally good, but there are a lot of dead ends and cul-de-sacs. There are some reflective address markers, but many homes lack these.

MOUNTAIN MEADOWS RECOMMENDATIONS

- **► F:** Roadside thinning and limbing on Arkansas Mountain road is recommended to reduce ladder fuels.
- **► F:** Remove large slash pile at top of escape route/Arkansas Mountain Road.
- Create a pre-plan for large animal evacuation.
- Implement CSFS planned treatments in a timely manner.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes not yet mitigated (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

► See ***Access Route Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

9. Mountain King

Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1, 2, 9
Water supply:	Yes
Hazards:	Inadequate access roads, poor addressing

Description: Mountain King is similar to Mountain Meadows in terms of fuels and topography, but the homes are larger and on larger lots. Most homes are mid-size to large and are of ordinary construction. Asphalt roof and wood siding construction are dominant. Roads are narrow dirt. There are some unmarked common driveways. Some homes are not marked at the street. There are inconsistent address markers and their placement is also inconsistent. Numerous fuels projects have been implemented including a mastication process.

MOUNTAIN KING RECOMMENDATIONS

- **► G:** Left Fork connects to the Arkansas Mountain Road, but it is in poor condition. This road should be improved for use as an evacuation/fire fighter access route.
- **► I:** Mountain King Road connects to Labelle Road. This road should be improved for use as an evacuation/fire fighter access route.
- **► H:** Roadside thinning and limbing to reduce ladder fuels should be conducted on sections of Mountain King road.
- **► H:** Clean up slash from mastication process to reduce fuel loading.
- Improve access to water source at 359 Mountain King Road.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

► See ***Access Route Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

10. Weaver

Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1, 2, 9
Water supply:	Yes
Hazards:	Long response time

Description: Weaver consists of low density properties (35 to over 200 acres). This community is located on the east face of Arkansas Mountain. Topography in Weaver is steep and complex. There are two cisterns, one on of which has a 16,000 gallon capacity. Some properties have a CSFS forest agriculture plan, and mitigation has been completed around some homes. Generally, there is open canopy Ponderosa with a grass understory broken by meadows, but there are also some significant stands of heavy, closed-canopy decadent Ponderosa pine. The area has a history of lightning ignitions. Wood siding and asphalt roof is dominant. Most homes do not have address markers at the driveway. Long steep, narrow dirt driveways are common. There is a historic barn ruin near the bottom of Weaver Road (about 120 years old). There are approximately 10 homes in this community.

WEAVER RECOMMENDATIONS

- **► A:** Roadside thinning and limbing should be conducted on Weaver Road to reduce ladder fuels.
- **► A:** This road could be improved for use as an evacuation/fire fighter access route to Betasso Preserve, specifically at **470 Weaver Road**.
- Continue to implement CSFS forest agriculture plan recommendations and update.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

► See ***Access Route Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

11. Boulder Canyon

Hazard Rating:	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1, 2, 8, 9, 10
Water supply:	Yes
Hazards:	Unrated bridges, high recreational use

Description: This community has scattered homes, most of which are on the creek side and can only be accessed over unrated bridges. In many instances there are multiple homes off single driveways and bridges. There are some steep, narrow driveways (especially at homes built on the side of the highway opposite the creek). Wood siding and asphalt roof is dominant. There have been multiple wildland fires in one of the gullies going north off the canyon on Conifer Mountain. There is riparian vegetation along the creek, but most homes are surrounded by heavy conifers. There are approximately 30-40 homes in this community, most mid-size on small lots. There is high recreational use in and around Boulder Canyon that increases the potential for ignitions from campfires and other human ignition sources.

BOULDER CANYON RECOMMENDATIONS

- Bridge load limits should be clearly posted.
- Road pull offs should be maintained and signed for emergency use
- Coordinate with law enforcement to patrol recreation areas for illegal fires.
- Remove decadent trees along Boulder creek below homes to reduce fuel loading.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

12. Old Post Office

Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	1, 2
Water supply:	Yes
Hazards:	Flashy fuels

Description: This community includes OId Post Office Road and Labelle Road. It is similar to Mountain King in terms of topography but there are fewer trees (more broken canopy) and more open meadow/grassland. Homes are mostly mid-size on mid-size to large lots. Wood siding and asphalt roofs are the most common construction type. Roads are dirt, but generally good. The Black Tiger Fire did burn some of this community but not as severely as Lost Angel.

OLD POST OFFICE RECOMMENDATIONS

- Mowing and maintaining low ground fuels is critical in this area due to the high grass component.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

13. Switzerland Park

Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	1, 9
Water supply:	Yes
Hazards:	Narrow dirt roads, poor addressing

Switzerland Park: This is an old resort community (founded 1906). Originally it was only seasonal use, but there are now some residences occupied year-round. The dominant construction type is small wood siding cabins with asphalt roofs. Most are close together, arranged around a central meadow. Other than the large central meadow, most fuels are mixed conifer (Ponderosa pine is dominant). Most of the cabins have trees growing right up against them. The water source is a stream with a dry hydrant (unlimited water). There is also a hydrant at the turn-off on Sugar Loaf Road. Access is on a narrow dirt road, but the surface is good and the topography of the entire community is flat. Very poor addressing (most cabins not marked).

***** Only structures around the meadow were considered in the community analysis. Other structures scattered around the area are at higher risk due to poor access and heavier fuels in and around them.

SWITZERLAND PARK RECOMMENDATIONS

- **►► 7:** Roadside thinning and limbing should be conducted on sections of Switzerland Park Road to reduce ladder fuels.
- **►► 7:** Create a shaded fuelbreak on East side of meadow.
- Mowing and maintaining low ground fuels is critical in this area due to the high grass component.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

►► See ***Proposed Landscape Fuels Modifications Recommendations*** in the main report for a more detailed description of this project.

14. Silver Spruce

Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	8, 9
Water supply:	Yes
Hazards:	Poor access

Description: Access to Silver Spruce is via a paved road, over two narrow, unrated bridges (one way in and out). Homes in this community are small to mid-size on small lots, with homes close together. Draft from creek requires a jet siphon, but does work (unlimited water). There is only one turnaround for apparatus (most cannot go past the second bridge). Addressing is poor throughout Silver Spruce, and there is little defensible space around homes.

SILVER SPRUCE RECOMMENDATIONS

- Bridge load limits should be clearly posted.
- Remove decadent trees along Boulder creek to reduce fuel loading below homes.
- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

15. Lost Angel

Hazard Rating:	**Low**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	5+ acres
Fuel models found in the neighborhood:	1**,** 2, 9, 10
Water supply:	Yes
Hazards:	Long response time

Description: Boulder View and Lost Angel do not connect, but they are adjacent to each other and are very similar from a wildfire prospective, so they are both included in this community. Homes in this community vary from small to large on large lots. Most were built or rebuilt after the Black Tiger fire (1989). In general, the homes are widely spaced. Roads in Lost Angel are dirt, and are steep and narrow in spots. Some of the spur roads are narrow, steep and rough. There are homes with both Sugar Loaf Road and Lost Angel Road addresses. This community is in the Black Tiger burn area and fuels are still light. Mostly short grass with scattered ponderosa, although there are a few homes with moderate tree cover. Address markers are inconsistent. Some road markers are in disrepair.

LOST ANGEL RECOMMENDATIONS

- Mowing and maintaining low ground fuels is critical in this area due to the high grass component.
- Correct confusing and/or inconsistent addressing.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge-tops or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals, such as conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Vegetation should be thinned away from access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access.
- Add reflective addressing to all driveways and homes.

APPENDIX C
STRUCTURAL TRIAGE AND PREPARATION

SIZE UP CONSIDERATIONS

- What is the current and expected weather?
- Are fuels heavy, moderate, or light? What is the arrangement and continuity of fuels?
- Note any hazardous topography.
- What have fires in this area done before?
- What is the fire's current and expected behavior?
  - What is the rate and direction of spread?
  - What is the potential for spotting and firebrands?
  - Will topographical features or expected weather changes affect the rate of spread?
- What are the number and density of structures threatened?
- What are the available resources?
- Will you have to evacuate people or animals?
  - Are there residents who will not evacuate?
- How hazardous is the structure?
  - What is the roofing material?
  - Are the gutters full of litter?
  - Are there open eaves and unscreened vents?
  - Does the structure have wooden decking?
  - Is there defensible space?
  - Are there large windows with flammable drapes or curtains?
  - What is the size and location of propane tanks and/or fuel storage tanks?

FIRE FIGHTER SAFETY

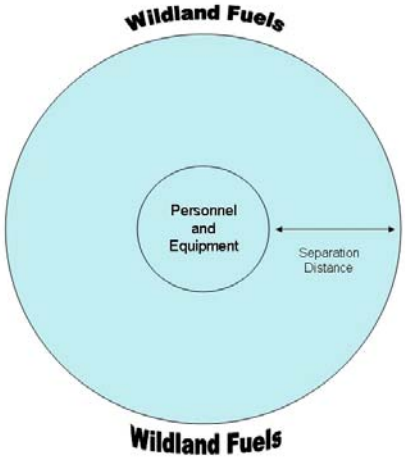
- What are the routes of egress and ingress?
  - What is the largest engine that can access the structure safely?
  - Are the roads two-way or one-way?
  - Are there road grades steeper than 8%?
  - Are the road surfaces all-weather?
  - Are there load-limited bridges?
- Are there anchor points for line construction?
- Are there adequate safety zones?
- What are the escape routes?
- Are there special hazards such as hazardous materials, explosives, high-voltage lines, or above-ground fuel tanks?
- Are communications adequate?

SAFETY ZONE GUIDELINES

• Avoid locations that are downwind from the fire.
• Avoid locations that are in chimneys, saddles, or narrow canyons.
• Avoid locations that require a steep uphill escape route.
• Take advantage of heat barriers such as lee side of ridges, large rocks, or solid structures.
• Burn out safety zones prior to flame front approach.
• For radiant heat only, the distance separation between the firefighter and the flames must be at least four times the maximum flame height. This distance must be maintained on all sides, if the fire has ability to burn completely around the safety zone. **Convective heat from wind and/or terrain influences will increase this distance requirement.**

Flame Height	Distance Separation (firefighter to flame)	Area in Acres
10 feet	40 feet	1/10 acre
20 feet	80 feet	1/2 acre
50 feet	200 feet	3 acres
75 feet	300 feet	7 acres
100 feet	400 feet	12 acres
200 feet	800 feet	50 acres
(1 acre = 208 feet x 208 feet, or the approximate size of a football field)		

CALCULATIONS ASSUME NO SLOPE AND NO WIND



Distance Separation is the radius from the center of the safety zone to the nearest fuels. When fuels are present that will allow the fire to burn on all sides of the safety zone, this distance must be doubled in order maintain effective separation in front, to the sides, and behind the firefighters. Area in Acres is calculated to allow for distance separation on all sides for a three person engine crew. One acre is approximately the size of a football field or exactly 208 feet x 208 feet.[1]

STRUCTURAL TRIAGE CATEGORIES

Sort structures into three categories:
1. Stand Alone or **Not Threatened**
2. Defendable
3. Not Defendable

- Factors that may make an attempt to save a structure too dangerous or hopeless:
  - The fire is making sustained runs in live fuels and there is little or no defensible space

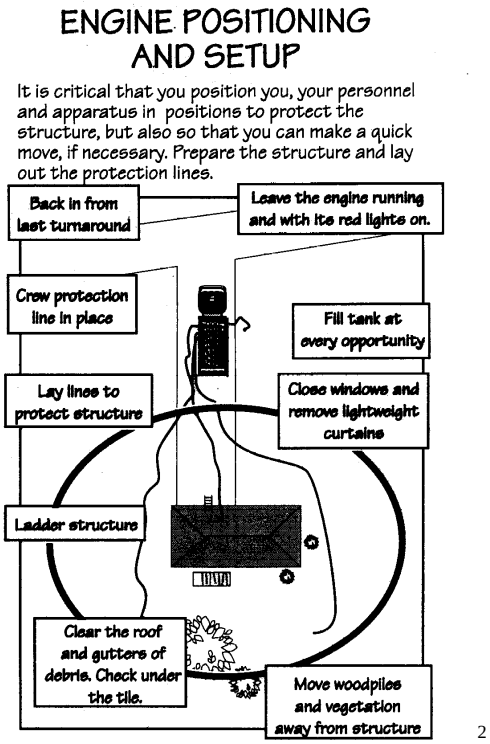
1 http://www.nwcg.gov/pms/pubs/nfes1077/nfes1077.pdf

- o Spot fires are too numerous to control with existing resources
- o Water supply will be exhausted before the threat has passed
- o The roof is more than ¼ involved in flames
- o There is fire inside the structure
- o Rapid egress from the area is dangerous or may be delayed

Common Ignition Points (remember, in windy conditions, firebrands can enter almost any opening)

- Flammable roof coverings and debris
- Unscreened vents, windows, or holes
- Open doors, windows, or crawl spaces
- Wooden decks, lawn furniture, stacked wood, and trash piles
- Openings under porches or patio covers

APPARATUS PLACEMENT CONSIDERATIONS



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2 Teie,William C.,1995, Firefighter's Guide, Urban/Wildland Situations. Deer Valley Press

APPENDIX D: ACCESS AND WATER SUPPLY RECOMMENDED GUIDELINES

INTRODUCTION

This appendix has been designed with public education in mind and is intended to be used to help familiarize homeowners, contractors, and developers with the general principles of the access and water supply needs of firefighters. The recommendations in this section are based on proven practices. However, they are not intended to be a substitute for locally adopted codes.

Emergency response personnel do their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for residents and their families, as well as that of the firefighters and emergency medical technicians that will arrive on scene. This is especially important in rural areas, where response times may be considerably longer than in cities.

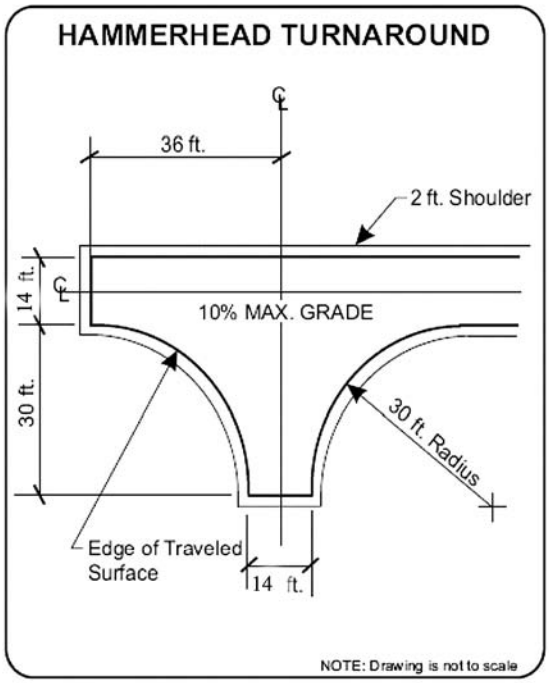
ACCESS GUIDELINES

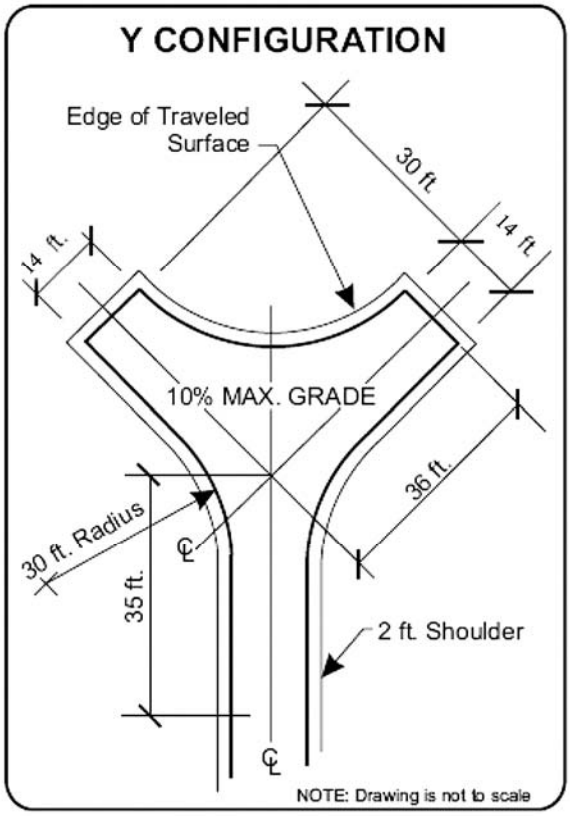
Driveway Turnarounds

Turnarounds that are unobstructed by parked vehicles are designed to allow for the safe reversal of direction by emergency equipment. The “Y” and “Hammerhead” turnarounds shown below are preferred because they provide the necessary access while minimizing disturbance to the site. Turnarounds should be located at the end of every driveway.

Driveway Width and Height

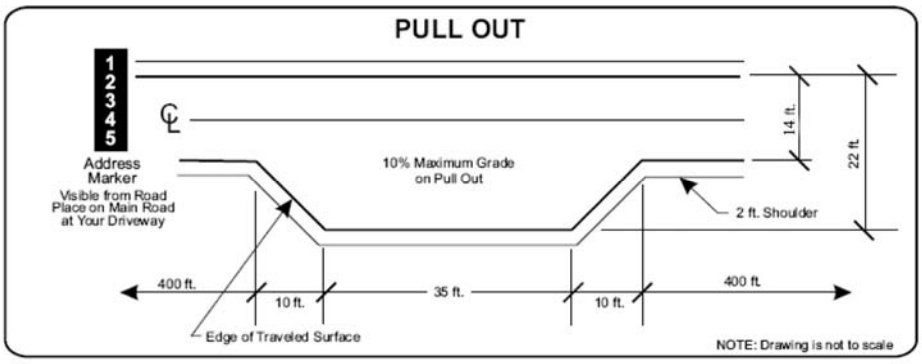
Driveways should have an unobstructed vertical clearance of 13 feet 6 inches. Trees may need to be limbed, and utility lines relocated to provide the necessary clearance. Driveways should have a 14-foot wide drivable surface and 14 feet of horizontal clearance.





Driveway Pullouts

Driveway pullouts are designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400-foot intervals along driveways and private access roads (community driveways). The location of pullouts may be modified slightly to accommodate physical barriers such as rock outcroppings, wetlands, and other natural or manmade features.



Address Markers

Every building should have a permanently posted, reflective address marker mounted on a non-combustible pole. The sign should be placed and maintained at each driveway entrance. Care should be taken to ensure that the location will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the

location and markings are adequate for easy night-time viewing. It is preferable to locate markers in a consistent manner within each community. A good guideline for this practice is to place the markers five feet above ground level on the right side of every driveway. Where multiple homes are accessed by a single driveway, all addresses that are accessed via that driveway should be clearly listed on the driveway marker. Where multi-access driveways split, each fork should indicate all residences accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate to simply mark addresses on a common pole in the center of the fork. Residential homes should have an additional reflective address marker permanently attached to the home in clear view of the driveway or access road. Homes that are marked by lot number while under construction should have the lot number removed and a permanent address marker posted before granting a certificate of occupancy.

Bridge Load Limits

Bridge load limits should be posted with a permanently mounted, reflective marker at both entrances to the bridge. Care should be taken to ensure that these markers will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location of the markings and the markings themselves be adequate for easy night-time viewing.

ALTERNATIVE WATER SOURCES

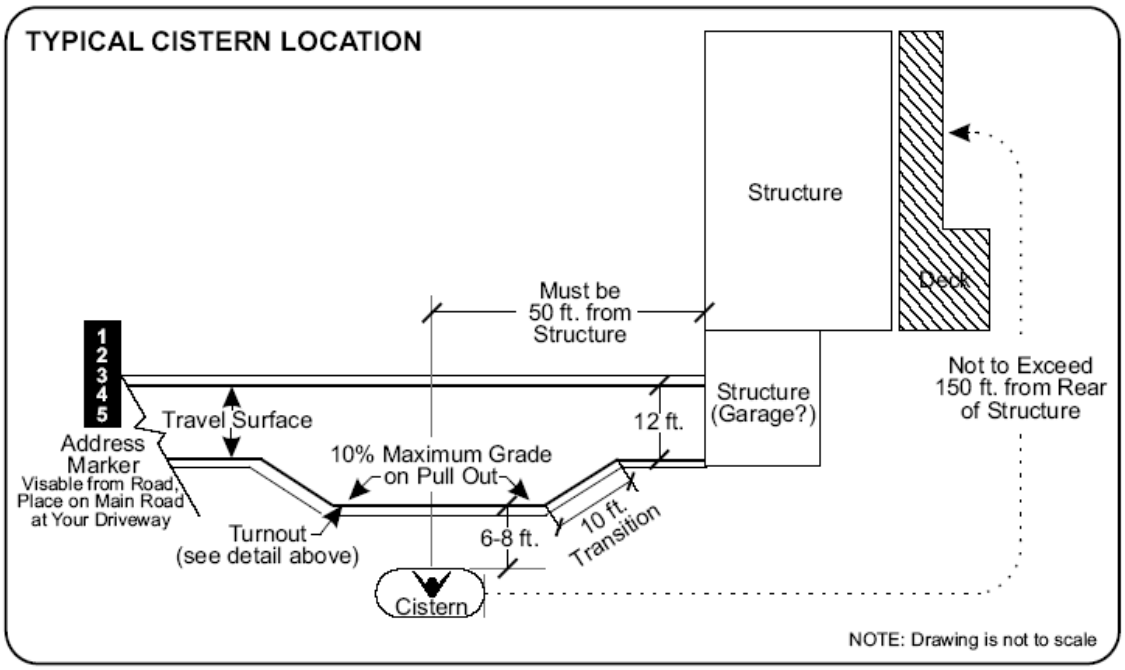
In the study area, like in many WUI areas in the west, water is a critical fire suppression issue. Although Parker Fire Protection District has a good network of pressurized hydrants, the hazard assessment revealed some homes which are a considerable distance from the nearest hydrant. The following information on the use of cisterns and dry hydrant installations has been included to provide information regarding supplementing existing pressurized hydrants, cisterns and natural water sources. It is not intended to be a replacement for existing water supplies. For more detailed recommendations regarding enhancement of the existing water supply system, please see the *Water Supply FMU* section of the main report.

Cisterns

Once emergency vehicles have arrived on site, they will need a dependable supply of water to help control the fire. Although residential wells with outdoor taps can be used by fire crews to help fill engine tanks, they are not adequate for fire control. If the property is a significant distance from a reliable water supply or fire station, it may be advisable to employ one of the following water supply options:

- An on-site 1,800 - 2,500 gallon cistern for each residence.
- A monetary contribution to a large community cistern fund.

For more information about local standards and regulations, please contact your local fire department.



Dry Hydrants

Dry hydrant installations allow much faster and more reliable access to ponds and tanks than conventional drafting. Specific recommendations for dry hydrant locations may be found in the *Water Supply FMU* section of the main report. Guidelines for the construction and maintenance of dry hydrants may be found in the *Dry Hydrant Manual* included as a supplement to this report.

It is always helpful to discuss any potential construction project with the fire department. Parker fire department officials can help determine what kind of access and water supply options will work best for your site. While the guidelines in this appendix have been assembled by querying firefighters with extensive Wildland-Urban Interface firefighting and fire code experience, local fire officials are in the best position to offer site-specific information.

APPENDIX E
SLFPD COLLABORATIVE EFFORT

THE NEED FOR A CWPP

In response to the Healthy Forest Restoration Act (HFRA), and in an effort to create incentives, Congress directed interface communities to prepare a Community Wildfire Protection Plan (CWPP). Once completed, a CWPP provides statutory incentives for the US Forest Service (USFS) to consider the priorities of local communities as they develop, and implement forest management and hazardous fuel reduction projects. In the case of Sugar Loaf Fire Protection District, the need for a community-based hazard and risk assessment (HRA) was born from an internal need, not a federal directive.

CWPPs can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, structure protection, or all of the above.

The minimum requirements for a CWPP are:

- Collaboration between local and state government representatives, in consultation with federal agencies and other interested parties.
    - Addressed in this appendix
- Prioritized fuel reduction in identified areas, as well as recommendations for the type and methods of treatments
    - Addressed in Main CWPP report (see recommendations sections)
- Recommendations and treatment measures for homeowners and communities to reduce the ignitability of those structures in the project area.
    - Addressed in Appendix B

PROJECT FUNDING AND COORDINATION

The SLFPD used the 2008 Colorado State Forest Service Wildland Urban Interface grant to complete a community-wide hazard and risk assessment and the resultant CWPP.

Future community education and private landowner assistance will be coordinated through the SLFPD. They will continue to identify funding for the implementation of mitigation projects.

INTER-AGENCY COLLABORATION

Roles and Responsibilities

To be successful, wildfire mitigation in the interface must be a community-based, collaborative effort. Stakeholders and, primarily, the SLFPD, will have the greatest

responsibility for implementing the recommended mitigation projects. The CSFS and the USFS will be valuable participants in addressing cross-boundary projects throughout the area.

Nearly all of the recommendations from this report affect private land or access roads to private land. There are also mitigation recommendations for individual structures, which are the responsibility of the homeowner. Homeowners will, however, need a point of contact – most likely a member of the SLFPD – to help them implement these recommendations. The best defensible space will be created with oversight and expert advice from the fire district and/or government forestry personnel. One-on-one dialog will continue to build the relationship with community members. This level of involvement will allow agencies to keep track of the progress and update this plan to reflect the latest modifications at the community level.

THE COLLABORATIVE PROCESS

"The initial step in developing a CWPP should be the formation of an operating group with representation from local government, local fire authorities, and the state agency responsible for forest management. (…) Once convened, members of the core team should engage local representatives… to begin sharing perspectives, priorities, and other information relevant to the planning process."[1]

Numerous federal, State, local, and private agencies (stakeholders) participated in the SLFPD CWPP. These stakeholders included:

- Sugar Loaf residents
- Sugar Loaf Fire Protection District
- Four Mile Fire Protection District
- Nederland Fire Protection District
- Indian Peaks Forest Alliance
- United States Forest Service
- Colorado State Forest Service
- Anchor Point Group

The true collaborative process was initiated through a stakeholder meeting held in June of 2008. The purpose of the meetings was to bring all past, current, and future efforts and needs to the table. The primary focus was on the identification and delineation of communities, areas of concern, and Values at Risk. Best practices and anticipated "roadblocks" were identified.

A second public meeting was held on September 9, 2008 to present the results and recommendations of the draft report. 23 residents and board members attended. There was support for the projects and interest in convening community meetings to start the process. Comments were incorporated into the final document.

[1] A handbook for Wildland-Urban Interface Communities March 2004, http://www.safnet.org/policyandpress/cwpphandbook.pdf

In addition, two surveys were conducted – one for citizens and one for officers. The results of the citizen survey are summarized below. The complete citizen survey results were given to SLFPD.

- Clean water and air, wildlife, views, and access to public lands are the characteristics that residents value most about living in the SLFPD.

- The highest concerns related to potential fire damage are personal safety and the safety of family members, as well as damage to homes. These are followed by damage to land and wildlife, property value loss, and loss of insurability.

- Although 50% of respondents feel "concerned" about the threat of wildfire, 43% feel "reasonably safe."

- Although a majority of respondents said they would be likely to evacuate in the event of a wildfire, a significant number – 36% – said they would likely stay at home. This may indicate a need for further wildfire education efforts in the SLFPD.

- Only half of the respondents have designated a meeting place for family members in the event of an evacuation.

- Most respondents support mitigation work, although some are only willing to do it if funding is provided.

- A majority of respondents have had either direct or indirect experience with wildfires. This may help to explain the high percentage of residents who would likely stay at home in the event of a wildfire.

- The vast majority of respondents feel that fire responders in their area are well equipped and capable. This is another potential contributor to the resistance of some residents to the idea of evacuation.

- One area of potential concern is in the area of resident wildfire education. Only 8% of respondents said they would be willing to help organize educational efforts regarding fire in the SLFPD.

FUNDING CWPP RECOMMENDATIONS

There are many sources of funds available for implementing the recommendations within the CWPP. Some available grants and websites where more information can be found are provided below.

- **Agency: Homeland Security, Office for Domestic Preparedness**
  - Purpose: to assist local, state, regional, or national organizations in addressing fire prevention and safety. The emphasis for these grants is the prevention of fire-related injuries to children.
  - More information: http://www.firegrantsupport.com/

- **Agency: Federal Emergency Management Agency (FEMA)**
  - Purpose: to improve firefighting operations, purchase firefighting vehicles, equipment, and personal protective equipment, fund fire prevention programs, and establish wellness and fitness programs.
  - More information: http://usfa.fema.gov/dhtml/inside-usfa/grants.cfm

- **Agency: National Volunteer Fire Council**
  - Purpose: to support volunteer fire departments
  - More information: http://www.nvfc.org/federalfunding.html

- **Agency: Community Facilities Grant Program**
  - Purpose: to help rural communities. Funding is provided for fire stations
  - More information: www.rurdev.usda.gov/rhs/

- **Agency: Firehouse.com**
  - Purpose: emergency services grants
  - More information: www.firehouse.com/funding/grants.html

- **Agency: Cooperative Forestry Assistance**
  - Purpose: to assist in the advancement of forest resources management, the control of insects and diseases affecting trees and forests, the improvement and maintenance of fish and wildlife habitat, and the planning and conduct of urban and community forestry programs
  - More information: www.usfa.fema.gov/dhtml/inside-usfa/cfda10664.html

- **Agency: Forest Service, Economic Action Programs**
  - Purpose: Economic Action Programs that work with local communities to identify, develop, and expand economic opportunities related to traditionally underutilized wood products and to expand the utilization of wood removed through hazardous fuel reduction treatments.
  - More information: www.fireplan.gov/community_assist.cfm

- **Agency: FEMA**
  - Purpose: Assistance to Firefighters Grant Program
  - More information: www.usfa.fema.gov/dhtml/inside-usfa/apply.cfm and www.nvfc.org/federalfunding.html